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NOTE.—The following contractions have been used in indicating the sources of Geographical Papers noted in the *Journal*.

Actes Soc. Scient. Chili. — Actes de la Société Scientifique du Chili. Santiago.

American Journ. Science—The American Journal of Science. New Haven, Conn.

Ann. Géog. — Annales de Géographie. Paris.

Bijdrag. Volkenkunde Nederl.-Indie—Bijdragen tot de Taal-Land- en Volkenkunde van Nederlandsch-Indië. The Hague.

Bol. Soc. Geog. Lisboa—Boletim da Sociedade de Geographia de Lisboa. Lisbon.

Bol. Soc. Geog. Madrid—Boletin de la Sociedad Geográfica de Madrid.

Bol. Inst. Geog. Argentino—Boletin de Instituto Geografico Argentino. Buenos Aires.

Bol. Soc. Geog. Italiana—Bollettino della Società Geografica Italiana. Rome.

Bul. Statist. Gen. Romaniei—Buletin Statistic General al Romaniei. Bucharest.

Bul. Acad. Imp. Sci. St. Petersburg—Bulletin de l'Académie Impériale des Sciences de St. Petersburg. St. Petersburg.

Bul. Soc. Anthropol. Lyon—Bulletin de la Société d'Anthropologie de Lyon. Lyon and Paris.

Bul. Soc. Géog. Lyon—Bulletin de la Société de Géographie de Lyon. Lyons.

Bul. Soc. Géog. Marseille—Bulletin de la Société de Géographie de Marseille. Marseilles.

Bul. Soc. Géog. Paris—Bulletin de la Société de Géographie. Paris.

Bul. Soc. Hongroise Géog.—Bulletin de la Société Hongroise de Géographie. Budapest.

Bul. Soc. Languedocienne Géog.—Bulletin de la Société Languedocienne de Géographie. Montpellier.

Bul. Soc. Roy. Géog. Anvers—Bulletin de la Société Royale de Géographie d'Anvers. Antwerp.

Bull. American Geog. Soc.—Bulletin of the American Geographical Society. New York.

Bul. Soc. Géog. Com. Bordeaux—Bulletin, Société de Géographie Commerciale de Bordeaux. Bordeaux.

Bul. Soc. Géog. Comm. Havre—Bulletin, Société de Géographie Commerciale du Havre. Havre.

Bul. Soc. normande Géog. — Bulletin, Société normande de Géographie. Rouen.

Bul. Soc. Roy. Belge Géog.—Bulletin, Société Royale Belge de Géographie. Brussels.

Bul. Soc. Anthropol. Paris—Bulletin de la Société d'Anthropologie de Paris. Paris.

Compt. Rend. — Comptes Rendus des Séances de l'Académie des Sciences. Paris.

Compt. Rendus Géog. Soc. Paris—Société de Géographie, Comptes Rendus des Séances. Paris.

Deutsch. Geog. Blätt.—Deutsche Geographische Blätter. Bremen.

Deutsch. Kolonialblatt—Deutsches Kolonialblatt. Berlin.

Deutsch. Kolonialzeit.—Deutsche Kolonialzeitung. Berlin.

Deutsche Rundschau—Deutsche Rundschau für Geographie und Statistik. Vienna.

Fennia—Fennia, Bulletin de la Société de Géographie de Finlande. Helsingfors.

Geog. Tidskrift (Copenhagen)—Geografisk Tidskrift. Copenhagen.

Jahresbericht Geog. Ges. München—Jahresbericht der Geographischen Gesellschaft in München. Munich.

Journ. and Proc. Roy. Soc. N.S.W.—Journal and Proceedings of the Royal Society of New South Wales. Sydney.

Journ. Asiat. Soc. Bengal — Journal of the Asiatic Society of Bengal. Calcutta.

Journ. Roy. Asiat. Soc. Ceylon—Journal of the Ceylon Branch of the Royal Asiatic Society. Colombo.

Journ. Roy. Colonial Inst.—Journal of the Royal Colonial Institute. London.

Journ. Roy. Stat. Soc.—Journal of the Royal Statistical Society. London.

Journ. Roy. United Service Inst.—Journal of the Royal United Service Institution. London.

Journ. Soc. Arts—Journal of the Society of Arts. London.

Journ. Franklin Inst.—The Journal of the Franklin Institute. Philadelphia.

Journ. Roy. Asiat. Soc.—The Journal of the Royal Asiatic Society of Great Britain and Ireland. London.

Miss. Cathol.—Les Missions Catholiques. Lyons.

Min. Proc. Inst. C.E.—Minutes of Proceedings of the Institution of Civil Engineers. London.

Mitt. Geog. Ges. Wien — Mittheilungen der kais - königl. Geographischen Gesellschaft in Wien. Vienna.

Mitt. Verein Erdkund. Halle — Mittheilungen des Vereins für Erdkunde zu Halle a/s. Halle.

Mitt. Verein Erkunde Leipzig—Mittheilungen des Vereins für Erdkunde zu Leipzig. Leipzig.

Mitt. [*Forsch.*] *Deutsch. Schutzgebiete.*—Mittheilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Berlin.

National Geog. Mag.—The National Geographic Magazine. Washington.

Norsk. Geog. Selsk. Arbog.—Det Norske Geografiske Selskabs Årbog. Christiania.

Nouv. Géog. — Nouvelles Géographiques (Le Tour du Monde). Paris.

Oest. Monats. für Orient—Oesterreichische Monatsschrift für den Orient. Vienna.

Peterm. Mitt. and *Pet. Mitt.*—Dr. A. Petermann's Mitteilungen aus Justus Perthes' Geographischer Anstalt. Gotha.

Proc. Roy. Artillery Inst.—Proceedings of the Royal Artillery Institution. Woolwich.

Proc. Roy. Soc. Victoria—Proceedings of the Royal Society of Victoria. Melbourne.

Revist. Soc. Geog. Rio de Janeiro.—Revista da Sociedade de Geographia do Rio de Janeiro. Rio de Janeiro.

Revue Géog.—Revue de Géographie. Paris.

Revue Française—Revue Française de l'Étranger et des Colonies: et Exploration, Gazette géographique. Paris.

Rev. Marit. et Colon.—Revue maritime et coloniale. Paris.

Scot. Geog. Mag.—The Scottish Geographical Magazine. Edinburgh.

Sitzungsb. Akad. Wiss. Wien—Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Vienna.

Sitzungsb. Preuss. Akad. Wiss. Berlin—Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin. Berlin.

Trans. Roy. Soc. Canada — Proceedings and Transactions of the Royal Society of Canada. Montreal.

Tijd. Indische Taal-Land-Volkenkunde—Tijdschrift voor Indische Taal-Land- en Volkenkunde, uitgegeven door het Bataviaasch Genootschap van Kunsten en Wetenschappen. Batavia and The Hague.

Trans. Geog. Soc. Pacific—Transactions and Proceedings of the Geographical Society of the Pacific. San Francisco.

Trans. Roy. Geog. Soc. Austral. (Victoria)—Transactions of the Royal Geographical Society of Australasia (Victorian Branch). Melbourne.

Verhandl. Gesell. Erdkunde Berlin—Verhandlungen der Gesellschaft für Erdkunde. Berlin.

Ymer — Ymer. Tidskrift utgifven af Svenska Sällskapet för Antropologi och Geografi. Stockholm.

Zeits. Gesell. Erdkunde Berlin—Zeitschrift der Gesellschaft für Erdkunde zu Berlin. Berlin.

Zeitsch. deutsch-österreich. Alpenvereins—Zeitschrift des Deutschen und Oesterreichischen Alpenvereins. Vienna.

The
Geographical Journal.

No. 1. JANUARY, 1893. Vol. I.

HOW CAN THE NORTH POLAR REGION BE CROSSED?

By Dr. FRIDTJOF NANSEN.*

Geographical exploration has now made rapid progress, and most of the Earth's surface is already fairly well known. There are, however, two regions of our globe which have hitherto obstinately resisted all explorers: these are the regions around the poles. As science has advanced, and the world has become more and more known, problems have arisen which can only be solved by observations in these regions; it is now hardly possible to study physical geography, geology, meteorology, and many other branches of science, without being stopped by important questions which can only be answered in the Arctic and Antarctic regions, and in regard to which we can at present only offer highly uncertain hypotheses. It is therefore natural that the interest of the scientific world should more and more be turned towards the exploration of these regions, and I feel certain that all scientific geographers agree that they ought to be explored without delay; but as to the way in which this ought to be done, I am afraid there is much difference of opinion.

Each polar region is interesting in its own way, and we are not at all entitled to say that the exploration of the one would be of more importance than that of the other. It is certainly the North Pole which has hitherto attracted the greatest amount of attention, but the chief reason for this is probably the circumstance that it is situated in our own hemisphere. There is a striking difference between the two poles. The South Pole is surrounded, at a considerable distance, by a great ocean, while it is probably situated in a large continent covered by an immense ice-sheet, thicker and much more extensive than that of Greenland. The exploration of this ice-sheet would be a scientific event of the highest importance, and no one can doubt that one day it will be

* Read at the Meeting of the Royal Geographical Society, November 14th, 1892. For map and diagrams see p. 96.

carried out. The Arctic regions, on the other hand, are on all sides surrounded by extensive land masses, while the neighbourhood of the Pole itself is covered by water. For this reason sailors have entertained the most fantastic ideas about an open Polar Sea, by which a short passage might even be found to the riches of China and India. They have tried to reach the Pole from all sides, but everywhere their hopes have been wrecked on the floe-ice, and the Polar Sea has been the grave of many a sailor's dreams of fame and wealth. I will here briefly mention the routes by which the principal attempts have been made.

Smith Sound was for some time thought to be the "high road" to the Pole, as some American explorers by this route had somewhat rashly professed to have seen the open Polar Sea stretching away to the north. All expeditions were, however, effectually stopped by floe-ice, carried down by a current from the north. Travelling over this ice was uncertain and difficult work, as may easily be concluded from the experiences of Markham, during his sledge journey towards the north on the Nares expedition. The most northerly points yet reached are, however, in this region, Markham having penetrated to lat. 83° 20′ N. (1876), and Lockwood, of the Greely expedition, to lat. 83° 24′ N. (1882).

Along the east coast of Greenland, attempts toward the Pole have been made, especially by the so-called second German North Pole expedition (1869–70). They were soon stopped by floe-ice swept southward by the polar current, and did not reach very high latitudes (c. 77 N.).

North of Spitzbergen, Sir Edward Parry made a most energetic attempt in 1827. When his vessel was stopped he left it, and tried to advance over the floe-ice, dragging boats and sledges with him. He reached lat. 82° 45′ N., where he was, however, obliged to return, as the ice was drifting so rapidly southward, that he could make no headway against it. In spite of the steamships of our time, nobody has reached Parry's latitude in this direction; but no serious attempt has been made since then.

In the direction of Franz Josef Land, attempts have also been made, but they have met with the same obstacle as elsewhere, viz. the polar ice. The ice was not here, however, carried southward, and this is a difference from what has been the case in the regions previously mentioned, which ought to be noticed. The Austrian *Tegetthoff* expedition was nipped off the coast of Novaya Zemlya, but was during one year and a half drifted in the ice north-east, north, and north-westward, till at last it was stopped by Franz Josef Land, which was thus discovered.

On the side of the Bering Strait only a few attempts have been made. The first was Cook's expedition in 1776, and the last that of the *Jeannette*

in 1879–81. Here, also, the same difficulty, the floe-ice, was met with, and in lower latitudes than anywhere else. The *Jeannette* was caught in the ice near latitude 71° N., and south-east of Wrangel Island. Here, we have, however, again a peculiarity as to the direction in which the ice is drifted; she was not carried southward but north-westward and nearer to the Pole. In this respect the *Tegetthoff* expedition, and that of the *Jeannette* differ from all others.

Why, then, have all previous attempts failed? The reason is simple enough. The expeditions were everywhere, at a greater or less distance from the Pole, stopped by the drifting floe-ice which formed immense impenetrable masses, and in most cases was carried down against the ships by currents from the north. It was impossible to penetrate the ice, and to walk over it was almost equally impossible, since it is moved by constant currents from the north; there was no choice left but to return. If we could only discover a land stretching to the Pole, the chances would be favourable enough. The difficulties of reaching it would not then be much greater than that of crossing Greenland. But we know of no country which is likely to have such an extension to the North. Greenland seems to end not very far north of the latitude already reached, and Franz Josef Land is probably only a group of islands.

Many people think that the North Pole can be reached by balloons or balloon ships, and that it will be so reached one day. I do not deny the possibility of this; on the contrary, I regard it as very probable. But the only way at present would be to entrust oneself wholly to the wind, and this is an uncertain way so long as we have no knowledge of the wind-currents of these regions. To go in a submarine boat under the ice would be rather risky so long as submarine navigation is as little developed as it is at present.

But is there no other way to reach the North Pole? I believe that if we take careful notice of the forces which Nature herself places at our disposal, and endeavour to work with them, and not against them, we shall find, if not the shortest, at all events the most certain route. We have already seen that most polar expeditions have been stopped by irresistible currents from the unknown north, carrying immense masses of thick floe-ice. From this fact we seem entitled to draw a very simple conclusion, namely, that if currents run from these regions, currents must also somewhere run into them, and that if expeditions have been carried by the ice southward from the unknown regions, others may be floated northward into those regions if they can only strike the currents on the right side. Thus, then, we have the way already indicated; the problem is to find the right place.

If we consider the experience of whalers and sealers who have sailed for a long series of years in the Arctic seas on both sides of the Pole, one singular circumstance must strike us at once, namely, that ships

caught in the ice on this side of the pole near the Greenland Sea are carried southward, and that the crews run, as a rule, no great risk. Not so on the other side of the Pole north of Bering Strait; ships caught in the ice there drift northward and often disappear, some with few and others with many men on board; most of them probably are destroyed in high unknown latitudes. These facts must lead the thoughtful observer to the conclusion that there are differences in the sea currents which may be utilised in favour of a polar expedition. Let us, therefore, examine the question more closely.

The most important polar current is, without doubt, that which runs southward along the east coast of Greenland. This has a considerable speed, and carries an immense quantity of water out from the polar basin. It fills the whole opening between Greenland and Spitzbergen, with the exception of a narrow belt along the coast of the latter, and it runs over the deepest known bottom in the Arctic regions; there are ascertained depths of 2600 fathoms. The depth of the actual current itself cannot, however, be so much; I do not think that we are entitled to assume that there is any current of importance deeper than 300 fathoms; and in order to be within the mark, let us say only 200 fathoms. It might be expected that under this polar current another current was running northward. From what we know of the water, we seem, however, to be fully entitled to say that such cannot be the case. On the contrary, water at a much greater depth probably comes from the unknown north. The breadth of the polar current on the surface is 250 nautical miles, and at the depth mentioned it seems to be about 170 nautical miles. To calculate the average speed of the current is very difficult; it runs probably more rapidly at the surface than in its deeper parts, and, on the other hand, the speed is nowhere constant during the whole year. Sometimes, especially in the summer months, it is very rapid, but at other times it seems to have a much slower course. Taking everything into consideration, I do not think we are entitled to estimate the average speed of the whole current for the year at more than two nautical miles a day. By this calculation we arrive at the conclusion that the polar current between Greenland and Spitzbergen *carries southward between* 80 *and* 120 *cubic miles of water every twenty-four hours.*

Whence is all this water derived? It cannot originate at the pole itself; the place of the water that flows out from the polar basin must be supplied by water running in. It is also evident that the influence of a current so considerable as this cannot be limited to a small area; it must affect the polar basin like an immense pump, sucking the water even from the shores of Siberia and Bering Strait. This is the more certain, as the polar basin is found to be unusually shallow wherever it has been sounded. There are only a few currents known which run into the polar basin. A small branch of the Gulf Stream is known to

run northward along the west coast of Spitzbergen. This current is, however, too insignificant to be of much value in this connection; to some extent it certainly also rounds the north coast of Spitzbergen, and returns southward again towards its eastern coast. The main body of the Norwegian Gulf Stream passes eastward to the north of Norway, and enters the polar basin north of Novaya Zemlya. This current is considerable; our knowledge of it is, however, not sufficient to enable us to form any certain idea about the quantity of water which it carries along; but according to the calculation of Prof. H. Mohn, in his important memoir on the Northern Ocean,* and according to information from the sealers, I think we may assume that it carries at least 60 or 70 cubic miles of water every twenty-four hours into the polar basin. A third current running into the Polar Sea is that which runs northward through Bering Strait. This cannot be of great importance, as the strait is so narrow and shallow, but from the latest descriptions of the current we are perhaps entitled to assume that at least 10 or 14 cubic miles of water are here running northward daily.

The currents certainly furnish the most important supplies of water to the polar current along the east coast of Greenland. Another addition comes from the American, and especially from the Siberian rivers that run into the polar sea. The drainage area of all these rivers is very considerable, embracing nearly the whole of northern Asia, or Siberia, besides the principal part of Alaska and British North America. The rain and snow of this region are not, however, very considerable, and the whole quantity of moisture falling over Siberia I have calculated to be no more than about 626 cubic miles in one year if the Russian meteorological data on Siberia are correct. On account of evaporation we cannot assume that more than a certain part of this water reaches the Polar Sea; perhaps not more than one cubic mile daily during the year. This is not much, compared with the size of the ocean currents, but this addition is of special importance, as it consists of fresh and comparatively warm water which principally runs out into the basin during the summer, and which for a very long time keeps at the surface of the sea on account of its lightness, and thus produces surface currents running northward from the Siberian coast. This is also the reason why there is so much open water along this coast every summer. To this stream of fresh water the evaporation from the melting of ice in the Polar Sea contributes very little. The moisture of the air over the area draining into the Polar Sea must consequently originate mainly in the Atlantic and Pacific Oceans. This constant addition of fresh water must evidently be the principal reason why the water of the polar current between Greenland and Spitzbergen contains somewhat

* Prof. H. Mohn, 'The North Ocean; its Depths, Temperature, and Circulation. The Norwegian North Atlantic Expedition, 1876–78.' Christiania 1887.

less salt, even at considerable depths, than the water of the North Atlantic seas.

We thus see that the polar basin is daily receiving a large inflow of water. As little evaporation takes place from its ice-covered surface, there must necessarily be a corresponding outflow, and the most natural outlet is the broad and deep opening between Spitzbergen and Greenland. According to what has already been said the water running out here seems very nearly to correspond in quantity to the inflow mentioned.

Currents also run southward through Smith Sound, Jones Sound, and Lancaster Sound, in the Arctic Archipelago of North America, but as these sounds are very narrow and shallow, the body of water which their currents carry off is of little importance in this respect. The current running southward between Spitzbergen and Franz Josef Land is also insignificant when compared to the east Greenland current. By considering the contributions of water already referred to which this last current probably receives, it may be possible to form some idea of the approximate course of this current through the unknown regions. The waters of the North American rivers form, very likely, a portion of the currents through the Arctic Archipelago of North America; a small part of the current through Bering Strait, perhaps, runs also in this direction. We have left then, for the formation of the east Greenland polar current, the Novaya Zemlya current, the Siberian rivers, a part of the current through Bering Strait, and the moisture falling over the polar basin.

It seems quite natural that these sources should converge, and to some extent unite to form the Greenland current. We must expect, therefore, to find the main body of the current which is formed in this way, lying somewhere to the north of the middle of that extended area from which it receives its converging sources, and this place must consequently be somewhere in the neighbourhood of the New Siberian Islands. Here we also have the mouth of the Lena River, which carries a considerable body of comparatively warm water northward into the Polar Sea. From this region the current must naturally run in a northerly direction by the shortest route to the outlet between Spitzbergen and Greenland, and this must be to the north of Franz Josef Land and near or across the North Pole. But the direction of the current may perhaps, to some extent, be disturbed by the winds. Unfortunately we do not know much of these in the Arctic regions; from the little we know it would appear, however, that the winds should be favourable for such a current, and that their average direction during the year is very nearly the same as that which we have assumed for the latter. This we can also conclude from the observations made during the drift of the *Jeannette*.

I have tried to convince you that, from what we know about the

ocean currents and the winds along the "threshold of the unknown regions," we are entitled, in fact are obliged, to assume that these regions are traversed by an ocean current. But is there no direct evidence of the existence of such a current? I think there is.

The American *Jeannette*, under the command of De Long, was on September 6th, 1879, caught in the ice to the east of Herald Island (north of Bering Strait at about lat. 71·30° N., long. 175° W.). This is the only case in which we know exactly the drift of a ship caught in the ice north of Bering Strait. Like all other ships caught there, the *Jeannette* drifted towards the north and north-west, but her course was at first very irregular, and to a great extent dependent on the varying winds. Her main drift, however, had a decidedly north-westerly direction; this course grew more and more direct the more the ship advanced westward, and during the last half year of her drifting she kept a pretty straight course, advancing north-westward with an average speed of no less than two miles daily, until she was crushed in the ice and sank on June 13, 1881, north of the New Siberian Islands (at about lat. 77° 15′ N., long. 155° E.). This drift of the *Jeannette* shows that a current must be running north-westward from the sea north of Bering Strait. This current does not seem to have been very strong during the first part of her drift, but as she approached the region to the north of the New Siberian Islands the current seemed to get a stronger and stronger hold of her, and the last week before she sank she often drifted along with a speed of more than eight miles daily. This was just near the region where I have already supposed the Greenland current to originate.

More remarkable, however, in this respect than the drift of the *Jeannette* itself, is the fact that a number of objects belonging to her or her crew were found on an ice-floe near Julianehaab, on the south-west coast of Greenland, just three years after she had sunk (June 18th, 1884). These objects, fifty-eight in number, were found by some Eskimo, and were afterwards collected by the director of the colony of Julianehaab, Mr. Lytzen, who has described them in a paper in the *Geografisk Tidskrift* (vol. viii., 1885–86, pp. 49–51), which is issued by the Danish Geographical Society in Copenhagen. Among these objects the following may be mentioned here:—1. A list of provisions with the signature of De Long, the leader of the *Jeannette* expedition, in his own handwriting; 2. A written list of the boats of the *Jeannette*; 3. A pair of trousers made of oiled linen, marked "Louis Noros," which is the name of one of the men saved from the *Jeannette*.

There seems to be some doubt as to the genuineness of these relics, and a well-known American traveller has even maintained that if the articles were found, it would seem more reasonable to trace them to the *Proteus*, which was wrecked in Smith Sound, about 1000 miles north of Julianehaab (in July, 1883). But how a list of provisions with De

Long's signature, a list of the boats of the *Jeannette*, a pair of trousers marked Louis Noros, &c., were brought on board the *Proteus* he does unfortunately not inform us. If the articles had still existed it would have been very easy to identify them, but unfortunately they are now lost. Mr. Lytzen sent them to a friend in Copenhagen, who had them for some time, and sent them to the International Exhibition at Amsterdam. After the close of the latter they were returned to the friend in a wooden case, and were placed in the cockloft in his house. A few years ago this man died, and his wife, not knowing what the articles were, allowed them to be destroyed, and I came just two months too late to save them. But I cannot see why these relics should not be genuine. What could the natives of Greenland know about the *Jeannette* and her sad fate? Or can it be supposed that Mr. Lytzen, a respectable official of Greenland, should have invented a story like this, and given a minute description of articles never found? Nobody who has read his description can easily believe such a thing, and that there should be any mistake or deceit is certainly much more improbable than the drift of a floe from Siberia to Greenland, which is certainly not at all improbable seeing that a great many other objects known must have drifted, and constantly do drift, the same way. The above-mentioned facts seem to speak for themselves, and need no further testimony. We have consequently to deal with the fact that an ice-floe, with objects from the *Jeannette* lying on it, was found near Julianehaab. These objects must have been left on the floe either near the place where the *Jeannette* sank or somewhere on the route of her crew towards the Lena delta. It is quite impossible that this floe could have come to the south-west coast of Greenland through Smith Sound, Jones Sound, or Lancaster Sound, as the currents through these sounds run southward along the west side of Baffin's Bay and Davis Strait, along the east coasts of Baffin Land and Labrador towards Newfoundland. No ice or objects coming that way reach the south-west coast of Greenland, along which a current runs northward, coming from the east coast (of Greenland) and round Cape Farewell, carrying along all the floe-ice and foreign objects which are found on the southern part of the west coast. There can consequently be no doubt that the floe which carried these relics from the *Jeannette* was borne along by the East Greenland current.

The question therefore arises: by what route did it travel all the way from the New Siberian Islands to the east coast of Greenland? The shortest and most natural route would, of course, be across the region to the north of Franz Josef Land, i.e. across the region round the pole; nay, we are obliged to assume this route as the only possible one. There is no probability that the floe should have been able to travel against the before-mentioned branch of the Gulf Stream, running eastward into the polar basin through the sound between Novaya Zemlya and Franz Josef Land, and that it should thus have passed westward to the south

of the latter, to the south of Spitzbergen and across the branch of the Gulf Stream, running northward along its western coast. Even if it were really possible that a floe could overcome all the difficulties of such a complicated route without being melted by the warm Gulf Stream, being broken up in the open sea, &c., it could not easily have travelled so far during so short a time as three years, seeing that the Austrians on board the *Tegetthoff* required one year and a half to be transported from Novaya Zemlya to Franz Josef Land.

These relics from the *Jeannette* thus seem to prove with all desirable clearness that there really exists such a current across the polar regions as that the existence of which we have assumed, from our knowledge of the currents of the northern seas. But there is other and even better evidence on which we can base our belief in the existence of such a current. Several years ago a "throwing-stick" or "harpoon-thrower" (a handle used by the Eskimo for throwing darts) of a peculiar shape was found on the west coast of Greenland, near Godthaab, and was afterwards given by Dr. Rink to the ethnological museum of Christiania. At first nobody knew whence it could have come, but on closer examination it appears that the only place where throwing-sticks of a similar shape occur is in Alaska, in the region of Port Clarence, Norton Sound, and the Yukon delta. The throwing-stick is, moreover, ornamented with Chinese glass beads which the Alaskan Eskimo get from the Asiatic side of Bering Strait. Thus it can have no other home than the west coast of Alaska, and it can only have reached Greenland in the same way as the objects from the *Jeannette*.

The best proof that the current must be constantly running from the sea north of Bering Strait and the Siberian coast, across the polar region, is the considerable amount of Siberian, and to some extent also perhaps of American, driftwood, which every year reaches the coasts of Greenland. The principal part of it is Siberian larch, and also red spruce. I have had the opportunity of examining a great deal of this wood on the west coast of Greenland as well as on the east coast. I have found it floating also on the sea among the floe-ice near Jan Mayen and Spitzbergen. Its appearance generally indicates that it has not been in the water for a very long time. For the Greenland Eskimo this driftwood is a necessity of existence, as it gives them material for all their weapons, implements, boats, sledges, tents, &c. Without it they would be in great distress, but they need not fear in that respect, for fresh supplies of wood are brought them every year by the polar current. Similarly, Siberian driftwood is found on Spitzbergen, especially on its northern coasts, and also *in the sea north of this land among the ice-floes carried southward from the unknown north* by that current against which Parry fought in vain. To this place the wood can only have come across the unknown north from Siberia, after having passed somewhere near the Pole.

A fourth proof that a current is constantly running across the polar regions is the thickness of the ice carried southward along the east coast of Greenland. This ice is much thicker than any other ice masses known in the northern seas. Ice of such thickness must have floated for a very long time in the sea; and as immense masses of similar ice are constantly carried southward, it cannot have been formed in the sea north of Spitzbergen or anywhere near the Pole, for in that case it would not have had time to grow thick in floating to the lower latitudes where we meet it. Along the Siberian coast, as well as in the sea north of Bering Strait, the ice is as a rule comparatively thin; during the drift of the *Jeannette* it was found that the average thickness was 7 to 10 feet. This must indeed strike one as being very strange, considering that the sea near the New Siberian Islands is part of the coldest region known on the earth. The reason is evidently that the ice of these seas is not generally more than one year old, as it is every year carried northward by the currents. It seems, then, to be a natural conclusion that it is the same ice which we find again in the East Greenland polar currents, and which has grown thicker on the way across the polar regions.

Quite recently I have received an interesting and remarkable confirmation that this conclusion as to the origin of the thick ice is right. During my last expedition to Greenland I collected samples of dust and mud from the ice-floes between Iceland and Greenland. These samples were some time ago sent to the Swedish geologist, Dr. A. E. Törnebohm, in Stockholm, who has now examined them, and found about twenty various minerals in them. The great variety of these minerals is striking, and in a letter to me Törnebohm says: "Can it be possible that the terrestrial portions of the dust originate from northern Siberia? that it is partly mud carried into the sea by the great Siberian rivers? The great variety of minerals contained in the dust seem to me to indicate that it originates from an extensive land region, and thus it seems most natural to think of Northern Siberia." At this remarkable conclusion has the Swedish *savant* arrived, as he states in a later letter, only judging from the nature of the mud itself, and even without knowing my views as to the polar current and the origin of the ice. But the more valuable is the opinion of such a prominent geologist. As will be understood, I quite agree with Dr. Törnebohm on this point, and I do not think there is room for much doubt, as some parts of the mud occurred in such thick and local layers that they could hardly have been brought on to the ice by anything but water. Even more interesting than the above-mentioned is, that a considerable part, or about the half, of the mud was of organic nature, mostly humus, which indicates that it originates from a soil containing much humus. It can consequently not be glacial mud carried out on the ice by the rivers of Greenland or other Arctic countries; it must have come from some other coast of

the polar sea, and we are again led to Siberia as the nearest and most natural home. Most interesting is, however, in my opinion, the diatoms found in some samples of dust from the surface of the snow of the floes. These have been examined by Prof. Cleve, of Upsala, the great authority on diatoms. He says of them: "The diatom flora of this dust is quite peculiar, and different from that of all the many thousands of samples which I have examined with the exception of one, with which it shows the most complete congruity, viz., a sample which was collected by Kjellman (during the *Vega* expedition) on the floe-ice at Cape Wankarema, near Bering Strait. The species and the varieties are completely the same in both samples." Prof. Cleve has been able to determine sixteen different species and varieties. All these were also found at Cape Wankarema, and *twelve of them are only known from there, and from nowhere else in the whole world;* and that though the diatom flora of the Kara Sea, Franz Josef Land, Spitzbergen, and Greenland has also been partly examined. Cleve is certainly right when he concludes his letter thus: "It is quite remarkable that the diatom flora on ice-floes near Bering Sound, and on the east coast of Greenland, are so completely alike, and so unlike all others. It indicates that there is an open communication between the seas east of Greenland and north of Asia." I think this is a most cogent proof of the correctness of my assumption, that the polar ice on the east coast of Greenland originates in the sea to the north of Siberia.

Another interesting proof, of a scientific nature, may also be mentioned here, which perhaps shows that there has been an open communication between the seas north of Europe and near Bering Strait in a post-glacial period. By examination of a great many specimens of pumice found on the shores of Norway, Spitzbergen, and Greenland, Bäckström, a Swedish geologist, comes to the conclusion that they consist of the group of minerals called Andesites, and cannot originate from any volcanic region in or near the Atlantic Ocean, as no pumice of similar structure and composition is now known in these regions. The pumice-stones must, therefore, in his opinion have been carried southward by the polar current, and must either have originated from unknown volcanoes in the polar regions, or from the great Andesitic volcanic regions near the Bering Sea. The latter supposition he thinks to be the more natural, and the pumice-stones have been floated northward by the current through Bering Strait and across the polar regions, along the route followed by the throwing-stick from Alaska. And as great quantities of this pumice-stone occur on the above-mentioned coasts, there must in a post-glacial period have been a constant communication by the aid of sea-currents between the latter region and the place where the pumice originated. As the pumice-stone is found at some height above the level of the sea, 30 to 70 feet, it must have been brought there by the sea in a period when the land had not yet risen to this height above the present shore. If Bächström's supposition is right this

shows that the communication between Bering Strait and the sea between Greenland and Europe is of no very recent date, and has in the post-glacial period been even more extensive than to-day, as the most northern shores of Europe were also favoured with it.

From all these facts we seem fully entitled to draw the conclusion that a current is constantly running across the polar region to the north of Franz Josef Land from the sea north of Siberia and Bering Strait, and into the sea between Spitzbergen and Greenland, and as we have seen, the floe-ice is constantly travelling with this current in a fixed route between these seas. Since such is the case, the most natural way of crossing the unknown region must be to take a ticket with this ice and enter the current on the side where it runs northward—that is, somewhere near the New Siberian Islands—and let it carry one straight across those latitudes which it has prevented so many from reaching.

There are two methods of trying to attain the result I long for. First, to build a strong ship so constructed that it can withstand the pressure of the ice, and living in this ship, to float across with the ice; or, second, to take only boats along, encamp on an ice-floe, and live there while floating across.

My plan is based on the use of both these methods. I have now built a wooden ship as small and as strong as possible; it is just big enough to carry provisions for twelve men for five or six years, besides the necessary fuel; her size is about 600 tons displacement with light cargo. She shall have an engine of 160 indicated horse-power, which will give her a speed of 6 knots, with a consumption of $2\frac{3}{4}$ tons of coal in twenty-four hours. With sails alone she will likely attain a speed of 8 or 9 knots under favourable circumstances. She will consequently be no fast vessel nor a good sailer; but this is of relatively little importance on an expedition like ours, where we shall have to depend principally on the speed of the current and the ice-movement, and not on that of the ship. A ship's ability to break her way through the pack-ice does not at all depend on her speed, but on her steam power and her shape. For it is naturally the thing of importance to get a strong ship, and the most important feature in her construction is, that she shall be built on such lines as will give her the greatest power of resistance to the pressure of the ice. Her sides must not be perpendicular, as those of ships generally are, but must slope from the bulwarks to the keel; or, to use a sailor's expression, her "dead rise" must be made great, so that the floes shall get no hold of her when they are pressed together, but will glide downward along her sides and under her, thus tending to lift her out of the water. The sides of most ships used in the Arctic seas have been almost straight up and down, in spite of which defect they have stood the pressure of the ice pretty well, and many of them have even been lifted completely out of the water, and have for longer or shorter times stood dry on the ice without being damaged. This

practically happens very often with the small sealing-vessels from the north of Norway which catch seals and walrus in the sea round Novaya Zemlya and Spitzbergen. These ships are often built merely of pine-wood, but yet they are lifted on to the ice; the captains think this a cheap way to get a dry dock and make use of the time to paint their ships, &c., until the floes separate again and the ship sinks into the water, so that they can continue their voyage. Though the *Jeannette* had a shape which in this respect was very bad, and though she was an old and not very strong ship, she managed to withstand the ice pressure for nearly two years twenty-one months. It will consequently be understood that a very slight alteration of shape will give us a very strong ship, and one which can scarcely be crushed by the floe-ice if it is properly handled. For the same reason the vessel ought to be as small as possible, as the lighter she is the more easily she will be lifted by the ice, and the less pressure there will be on her sides; it is also easier to make a small ship strong than a big one. A small ship has other advantages, as it is more convenient to navigate and to handle in the ice, and it is easier to find good and safe places for it between the floes.

As great length is a weakness during the pressure and twisting of the pack-ice, the ship ought also to be as short as her necessary bearing capacity will allow. The result of this in connection with the very sloping sides is, that our ship is disproportionately broad compared with her length. Her breadth is about one-third of the latter. Flat sides are avoided as much as possible near the places which will be most exposed to the attack of the ice, and the hull has plump and rounded forms. There are no sharp, projecting corners; every edge is broken and rounded. Even the keel does not project very much; it is almost covered by the plankings, and only 3 inches are visible outside the ice-skin, and the sharp edges are quite rounded. On the whole the ship will, I hope, leave no place for the ice to catch hold of. Round and slippery like an eel, she will escape its cold and strong grasp.

The ship will be pointed at both ends, and, on the whole, she resembles very much a Norwegian pilot-boat, or, as I am told, a Scotch buckie-boat, only that she of course is carvel-built, and that the keel and the sharp bottom are cut off. Her bottom is near the keel, comparatively flat, in order that she shall have something to rest on without being capsized in case she should be completely lifted on to the ice. Both stem and stern are considerably curved in order that the ice shall get no hold there. The stem is also much sloped, because it will then more easily force the ice-floes under her when she is breaking her way through the ice.

The screw can be raised when necessary, and protected from damage in a well. It can also easily be changed if it is broken, and for that purpose we shall carry two reserve screws. This is, as will be known, a

usual arrangement in modern sealers or whalers; but besides this, the rudder can also easily be unshipped and raised through a well. This is, I think, a fortunate and ingenious idea of the shipbuilder, Mr. Colin Archer, and it is a very simple arrangement. The rudder is, moreover, placed so low that it will be entirely submerged even when the ship is lightly loaded. This is so arranged in order that the ice shall not be able to strike it, and thus break it by even a sudden pressure or movement; it will instead meet the strong stern. The latter is the Achilles heel of the sealers and whalers, where the ice may very easily damage them by breaking the rudder. During my last voyage with the *Jason* to the east coast of Greenland we had such an accident, showing how easily it may happen. When the rudder, then, is not so arranged as in our ship, it takes a long time to have it unhooked and another put on, especially when you have no great crew. Our stern is, as usual, furnished with two perpendicular stern-posts, one a propeller-post, the other a rudder-post, made of big oak timbers about 27 inches broad. On both sides of these are bolted very big and strong curved oak timbers, running along the sloping stern upwards to the deck, thus forming in a way a double stern. Between them are the wells, through which the screw and rudder can be lifted. This stern construction is very simple, and certainly exceedingly strong.

The stem is of course also made very strong. It is composed of three big oak baulks, one inside the other, so that the thickness of solid oak is 50 inches. Inside the stem big and strong breasthooks of oak and iron are placed to connect the ship's sides with each other and with the stem. From these breasthooks stays go to the pawlbit, in order to strengthen the stem and divide the pressure. Outside this wooden stem comes an iron one, and outside this again come transverse iron bars and plates, which go some small distance backwards on each side, to protect the wood against the ice.

Both the stem and the stern-posts are, of course, carefully attached to the keel by strong cross and longitudinal iron clamps and wooden knees. When I add that the stern is also protected by an iron sheeting, it will, I hope, be understood that the two extremities of our ship are pretty well protected.

The keel is made of two big baulks of American elm, 14 inches square. As is already mentioned, it will be almost covered by the outer planking, so that there will only be a projection of a few inches. Above the frame timbers are placed two keelsons, one 17 inches and the other 12 inches in height, both bolted together to the timbers and keel.

The frame timbers are made of selected Italian oak, which is very hard. Only naturally-curved timbers are used; such are much stronger than those curved by the help of the axe. These timbers were

originally meant for some man-of-war, and were thirty years ago bought for the Norwegian navy; they may thus be said to be well-seasoned. The thickness of the frame timbers is about 10 to 12 inches; they are ranged in couples, squared, and bolted together, all joints being bound with iron. The pairs of frames are placed almost close together, leaving only a space of 1 to 2 inches between each. These spaces were left in order to give the very dry timbers a little room in case they should swell when they come into water; the spaces are, however, filled with a mixture of pitch, tar, and sawdust, so that if the outer plankings were shaved away the vessel would still remain nearly water-tight.

The ceiling consists of pitch-pine planks, alternately 4 and 8 inches in thickness. It is twice carefully caulked with oakum to make it tight. The planking consists of three layers; first, a 3-inch oak layer, over which another of 4 inches, and finally an outer planking, or "ice sheathing," of greenheart, which increases in thickness from the keel towards the water-line from 3 to 6 inches. Greenheart is, as you will know, a very hard, strong, and slippery wood, well fit to protect the hull against the damage of the ice, its only fault being that it is so heavy that it sinks in water. Each layer was carefully caulked with oakum and pitch in the ordinary way before the next skin was placed on to it.

The whole thickness of sides of the ship is thus 28 to 32 inches —a solid mass of pitch-pine, oak, and greenheart, with a little pitch in between. It will easily be understood that a ship's side of such dimensions and material will alone have a great power of resistance to the pressure of the ice. But this power is, to a very essential degree, increased by the many beams, stays, and strengthenings of every kind placed inside the vessel. How these are arranged will be seen in the diagrams (Fig. 5). There are two decks, an upper and lower one, each of 4-inch red pine. The deck beams are of oak and pitch-pine 10 or 11 inches square. Numerous upright stanchions and stays are placed as supports to the beams and the sides; they unite the beams of the two decks to each other and to the ship's sides. The principle of arrangement of the stays is, that they shall be placed as perpendicular on the ship's side as possible, in order to strengthen these against pressure from the outside, and to divide the latter. For this purpose the perpendicular stays between the beams of the two decks, and between the lower deck-beams and the keelsons, are also very well fitted. As may be seen in the drawings, stays, beams, and the ship's sides are strongly united to each other by large wooden knees and iron. The whole is like one coherent mass, and the ship may almost be considered as if built of solid wood.

The beams of the lower deck are placed somewhat under the water-line, where the pressure of the ice will be worst. In the after-part, above the engine, we were obliged to raise the deck a little, in order to

give room for engine and boilers; but instead the beams are here supported by two sloping stanchions on each side instead of one, so that also this part must be considered as very strong. As the lower deck was raised, we were also obliged to lift the upper one in order to give room for the cabins. These are thus covered by a half-deck, or poop, 3 or 4 feet in height.

The whole ship is divided into three rooms, or divisions, by two water-tight wooden bulkheads, so that if the vessel, in spite of all, should happen to spring a leak, there will still be two water-tight divisions left to keep her floating. She is also furnished with pumps, one of which will be a great centrifugal pump, which may be driven by the engine and put into communication with all the divisions, and thus empty the vessel in a short time in case she should leak.

The most important feature in the rig of a polar vessel ought to be, that it is as simple and as strong as possible, and at the same time it should be light, and make little resistance to the wind when the vessel is steaming. For these reasons we have chosen to rig her as a three-masted fore-and-aft schooner, the sails of which are very easy to handle from the deck, which also is of some importance when you have a small crew not consisting of first-rate sailors only. On the foremast there will also be two loose yards for a square foresail and topsail. The area of her sails will be about 650 square yards. The under-masts are rather high and strong; the mainmast is 82 feet in length, and the topmast is 50 feet. On the top of this is the crow's nest, which thus will be at a height of about 105 feet above the water. It is of importance that the crow's nest be placed as high as possible, in order to get a wide view over the ice.

The quarters for officers and crew are so arranged that the saloon (Fig. 4, S), is in the middle, on all sides surrounded by the cabins (L, L, Fl), the galley (K), and the bunkers (B); thus, by help of these rooms, the saloon is well protected against the cold and moisture arising from the ship's sides. One of the greatest difficulties with the life on board the vessels of most polar expeditions has been, that the moisture of the warm air in the small cabins was condensed on the cold sides of the ship, and was there frozen to ice. The mattresses in the berths on these walls were therefore very often transformed into as many lumps of ice. To avoid a repetition of this has, of course, been of importance to us. We have therefore located the saloon as described in order that we may all live there night and day, in case it should be necessary, during the most severe cold. We shall thus follow the same principle as the Eskimo, living many people in a small room to make it warm; we shall certainly not then want much to heat it.

But besides this, every precaution is taken to isolate the walls and make them warm, and to prevent the moisture being condensed on them. The ship's sides are, on the inner side, covered with tarred felt; then

comes a thick layer of cork; inside this a wooden wainscot; then a layer of felt a few inches thick; next comes a nearly air-tight layer of painted canvas, or linoleum; and then another wainscot. The air-tight canvas is there in order to prevent the warm and moist air from inside penetrating into the layers of felt and cork, and giving off moisture there, thus transforming them into ice. This principle we have followed, on the whole, also in the roof. The walls between the cabins and the saloon are made in a similar way, and the roof and floor are very thick, consisting of many layers. In the roof there is, amongst others, a layer of reindeer-hair a couple of inches thick, which I think must be very effective as a heat insulator, as the reindeer hairs are so very porous and elastic. On the floor and walls may of course also be laid bear-skins and carpets, to make them still warmer. I hope you will get the impression that everything is made to give us a snug and comfortable saloon and cabins, fit for a climate such as we may expect.

The principal dimensions of the vessel are as follows:—Length of keel, 101 feet; length at water-line, 113 feet; length over all, 128 feet; beam at water-line amidship, excluding the "ice-sheathing," 33 feet; greatest beam, excluding the "ice-sheathing," 36 feet; depth moulded, 17 feet; the draught with light cargo is 12 feet; the displacement is then about 530 tons, but when, with heavy cargo, the draught is 15½ feet, the displacement will be about 800 tons. Her freeboard will then be only 3½ feet. Such will probably be the case when we leave the last place where we can get coal, as we will of course then load her with as much as she can carry. We will soon burn a good deal in the engines, and she will gradually be lifted again.

The hull, with boilers filled, weighs about 420 tons. With a displacement of 800 tons, she has consequently a bearing capacity for 380 tons of coal and cargo. Our equipment and provisions will not likely weigh much more than 60 or 70 tons; thus 300 or 320 tons' bearing capacity will be left for coal and fuel, and this is enough for about four months' steaming with full speed. We shall not, however, likely be able to make use of our engines more than two months after we have been loaded with coal for the last time. A great quantity will thus be left for heating and cooking during the winters. For heating purposes we shall also carry petroleum, which has the great advantage of giving light besides. For the cooking we shall carry alcohol.

The vessel was launched at Laurvik on the 26th of October, and was named *Fram*, which means "forward." I hope she will accomplish what this name promises.

Fram will certainly be the strongest vessel ever used in the Arctic regions. She is built with great care, and I feel certain that she can be crushed only in a quite extraordinary combination of circumstances. With this vessel, and a crew of twelve strong and well-picked men, besides an equipment for five or six years, as good in all respects as

modern appliances can afford, I think the enterprise has a good prospect of success.

It is my intention to start next spring. Our first goal will be the New Siberian Islands or the mouth of the Lena River. I have been uncertain whether I will go through the Kara Sea, or will prefer the route from the side of Bering Strait; but think now that I shall take the former. When we have reached the sea north of the Lena delta we shall have to wait for the right moment to go northward along the western coasts of the New Siberian Islands, and try to reach the farthest possible point north in open water. This will probably be in August or the first days of September. The current caused by the warm water from the Lena River will certainly be a great help to us, as it seems to be of great influence during the summer, producing an extensive open sea, in which one of the boats from the *Jeannette* was even wrecked. To be able to navigate the ship properly through the ice I thought of using captive balloons. By help of these we could easily in clear weather get a splendid view over the surroundings, and see where there is ice and in what direction there is open water; we should then in a moment see what direction to take as clearly as if we had it traced on a chart, and should lose no time by trying in a wrong direction. The great difficulty is, that there is very much fog in this region just on account of the warm Lena water; but a good clear day with balloon work would then be the more valuable, and would make up for a great many others with fog. A still greater difficulty is, however, that the balloon equipment, especially the steel cylinders with the compressed hydrogen, are so heavy that I fear it would be too difficult to carry them in our small ship, and as they are also very expensive, I fear I shall have to give them up.

When we can get no farther we shall have nothing left but to run into the ice at the most favourable spot, and from there trust entirely to the current running across the polar region. The ice will perhaps soon begin to press, but it will only lift our strong ship. While drifting we shall have plenty of time and excellent opportunity to make scientific observations. Probably we shall in this way, in the course of some years, be carried near the Pole, or across it, and into the sea between Spitzbergen and Greenland, where we shall get into open water again, and be able to return home.

There is, however, a possibility that the ship, in spite of all precautions, may be crushed in the ice; but if this happens the expedition will have another resource. It will now be time to use the ice as quarters instead of the ship, and we shall have to move all our provisions, coal, boats, &c., to an ice-floe, and camp there. Besides the light ordinary boats I have built two big boats for this purpose, 29 feet long, 9 feet broad, with flat bottom, and so deep that we can sit and lie comfortably inside them. They have a deck, and are so big that the whole crew can live

even in one of them. These boats will be placed side by side on the ice, will be covered with thick warm tents and snow, and will give us two good warm saloons. Thus we can continue our journey. There is certainly no reason why one should not be able to live comfortably enough in this way if one is only prepared for it. The only difference will be that we have now got two small ships standing on the ice instead of the big one lying between the floes. When we emerge into open water on this side of the Pole there will not be any great difficulty in returning home in our boats; such a thing has been done many times before.

It is my conviction that the only difficulty will be to get duly into the current north of Siberia; when this is fortunately done, we must be carried somewhere northward. There is no case in which a ship has been nipped in the pack-ice without being carried in some direction. Whether we will succeed or not, I feel convinced that this is the way in which the unknown regions will some day be crossed. To travel in this manner is certainly no new fashion; it has been tried many times before. I need only remind you of Sir Leopold M'Clintock's drift with the *Fox* during eight months in the winter of 1857-58, when he drifted 1200 miles from the northern part of Baffin's Bay down towards Labrador. Several years later (1872) a party from the *Polaris* expedition drifted on an ice-floe even a longer distance very nearly along the same route. Along the east coast of Greenland many such ice-drifts have occurred. I may remind you of the whole fleet of whalers—about twenty-eight in number—which in June, 1777, were nipped between lat. 74° and 75° N., and which drifted in the ice southward along the whole East Greenland coast. The last ship was crushed in October, in lat. 61° 30′ N., after having drifted a distance of 1250 miles in 107 days. Some of the men continued the drift on the ice, rounded Cape Farewell, and reached at last the Danish settlements on the west coast, their whole drift being about 1600 miles or more. In the winter of 1869 and 1870 the *Hansa* crew drifted on an ice-floe, as you will remember, along the same coast, very nearly the same route, and the same distance as the whalers in 1777, until they, after nine months, arrived safely at a settlement west of Cape Farewell. During our attempt to land on the east coast of Greenland, in 1888, we also, as will be known, had some little experience in this drifting, and in 1882 I also tried a little of it with a Norwegian sealer.

In the sea between Novaya Zemlya and Franz Josef's Land the Austro-Hungarian expedition in the *Tegetthoff* drifted for a period of one year and a half; but as I have already mentioned, a striking difference between this drift and those above-mentioned is, that it had no southern direction, it went *north-east*, *north*, and *north-westward*. In this respect the drift of the *Jeannette* during two years from a point to the north of Bering Strait is also most remarkable, as it went in a *north-westerly* direction.

It will thus be seen that drifting in the ice is no new mode of travelling in the Arctic regions, neither is it new to make discoveries in this way. During the drift of the *Tegetthoff* the most important Arctic discovery of recent times was made, viz., Franz Josef Land, and during the drift of the *Jeannette* several islands were discovered. The only new feature in my plan will be, that *I wish* to be drifted, while these previous expeditions drifted *against* their will.

There is a possibility that we may be stopped by unknown lands near the Pole, or that we may strike an eddy or a side current, but we hardly run any great risk in any of these cases. If, in the former case, we should fail to get our ship afloat again, we should have to leave her and strike out for the nearest current to drift on again, or return homeward travelling over the ice. When we only take care to travel with the current and not against it there will certainly be no special difficulty in doing this; and if the distance should be too great, we should leave all boats, taking only light sledges with necessary provisions, &c., besides canvas for boatmaking, walk on until we reached Spitzbergen or any other land where there is open water. Here we would make boats of canvas, or if possible of the skins of seals or walruses, like that we made when we reached the west coast of Greenland. If we are caught by a side current this must at last bring us somewhere; it cannot for ever run in a ring near the Pole; and wherever we come near the coasts of the Polar Sea we shall have no difficulty in returning home. It may be possible that the current will not carry us exactly across the Pole, but *the principal thing is to explore the unknown polar regions*, not to reach exactly that mathematical point in which the axis of our globe has its northern termination.

The only experience which can give us some idea as to the time the current will require to drift the expedition across is the drift of the relics from the *Jeannette*. If we assume that they required one year for the drift southward along the east coast of Greenland from latitude 80° N. only two years remain for the rest of the journey, and this requires a speed of no more than two nautical miles daily. This does not seem too high a rate when we remember that the *Jeannette* drifted at the same speed the last half year of her drifting. It cannot therefore be considered improbable that we should reach open water on this side of the Pole within two years after our start from the Siberian side. One cannot, however, expect that the course will be one straight line forward during all this time. There will certainly come periods during which the drift is quite stopped, or when we may even be carried backward, and the route and time can thus easily be lengthened; but when we, as already mentioned, take provisions for five or six years we may consider that we have an ample margin. This may perhaps seem to many to be a long time, but there is a great advantage in this route, and that is, that when the expedition is once well begun there will not be much help in looking

backwards; our hope will then lie on the other side of the Pole, and such a knowledge is a good help to get *Fram*, or forward.

There are a great many things in our equipment which ought also perhaps to be mentioned; but as this paper has already become so long, I shall only mention a few of the most important points.

To get fresh food we will shoot as much as possible, and for this purpose we will carry light sealing boats as also Eskimo kayaks. The use of these excellent light craft I learnt to appreciate in Greenland; they are very good to shoot and fish from, can easily be carried long distances over the ice, and can be used wherever there is a little open water.

To make excursions over the ice in case we shall meet with land—which of course is very likely—we will take dogs, sledges, "ski" and snow-shoes with us, besides full equipment for sledge-travelling. I hope to spend a great deal of the time in this way by making excursions in all directions where anything of importance may be expected. For entertainment during the long winter nights, as well as for all kinds of scientific work, a good library will naturally form a most important part of our equipment.

Our scientific equipment will be chosen with the greatest care, and the best instruments accessible will be taken. I shall not, however, tire you with an enumeration of them; they will naturally, to a great extent, be much like what other Arctic expeditions have had. I may only mention that I have also got a pendulum apparatus and the necessary astronomical universal instrument, in the hope that we may get some opportunity of making pendulum observations on northern latitudes, which is of course of the greatest interest.

One of the greatest difficulties we will have to overcome will perhaps be the scurvy. It has been very bad on many previous expeditions, and during the long time we expect to be away it is not impossible that it might occur. I do not, however, consider this to be very probable. I am examining the question very closely, and all possible precautions are being taken to avoid it. In our time science ought to be able to produce an equipment as regards provisions which will make scurvy an impossibility. It is a ghastly enemy, that is true, as we do not know its nature and origin. But it seems as if it almost never occurs except in connection with badly-preserved meat, and especially salted meat, and I cannot understand why then we should take such a thing with us; there is plenty of other things to choose among. Alcoholic drinks will of course not be taken.

To live a healthy life in all respects is naturally very important. Two of the principal conditions to keep one's health are, heat and light. In order to produce the necessary heat, we live together in a small room during the coldest season, as is already mentioned. We will also have good warm clothes. Woollen ones I regard as best for indoors, but in

the open air, skin or canvas suits to put outside the woollen clothes are necessary to protect one against the biting wind and the snowdrift. To heat our saloon there will certainly not be much wanted even during the severest cold. A few paraffin lamps or a small paraffin stove will certainly be sufficient. There will of course also be care taken to get good ventilation. We thus run no risk, I think, of suffering from the want of heat. With the light it is, however, worse. Almost no organism can exist without that, and therefore various illnesses occur during the long Arctic nights. This it would seem difficult to avoid in regions where the darkness lasts six months. I believe, however, that we shall be able to overcome this difficulty also by help of the wonderful electric light. We shall have a dynamo for producing electricity. Many will perhaps ask how we shall get the necessary power to make it work. This cannot, however, be difficult. On one hand we have the wind. The meteorologists are certainly of opinion that this will not, as a rule, be very strong in the cold over the Polar Sea; but a little we must find there also, and if the sails of our windmill are made sufficiently big, we do not want much to turn them. But even when there is no wind at all we will be able to produce power. We are twelve men, strong, and well-picked, as I hope, and when a capstan is arranged on deck we will be able to do work similar to that which a horse does in its horse-mill on land. In this capstan four men take their turn at a time; thus we will obtain good and regular exercise—somewhat monotonous perhaps—and will at the same time be useful by producing electricity, so that we can have an electric arc-lamp burning eight hours a day. Everybody will understand what a blessing that must be when one is surrounded by constant darkness. When the sun begins to sink to disappear behind the horizon in the south for the last time we begin to walk in a ring in the darkness on the deck of our ship, in order to produce a new sun. In this way we will slowly move forward. I hope that you, ladies and gentlemen, will sometimes send us a kind thought while we go round in our mill there far north in the solemn silence of the long polar night.

Admiral Sir Leopold M'Clintock: I think I may say this is the most adventurous programme ever brought under the notice of the Royal Geographical Society. We have here a true Viking, a descendant of those hardy Norsemen who used to pay this country such frequent and such unwelcome visits. One cannot but admire Dr. Nansen's splendid enthusiasm. He has adduced some very striking proofs as to the current to which he intends to trust himself and his companions; he has shown us that the current is proved to extend to the north-west from Barents Strait, at least to lat. 77°; has reminded us of the Dutch fleet frozen in on this side the Pole in lat. 78°–80° between Spitzbergen and Greenland, and which drifted south, sometimes in sight of Greenland, sometimes in sight of Iceland, until the last one was crushed somewhere near Cape Farewell. Thus we have a north-west current running in, and a south-west current running out, and the unknown intervening space, the so-called Polar Basin, is 1500 geographical miles; and this is just

the space which has so many attractions for Dr. Nansen, that he proposes to drift across it. I wish to say only a few words, and those with reference to the minor currents, with which I am personally acquainted or have had some experience. We find on the American Islands an enormous pressure of Polar ice, very different in character from anything further south, pressing in from the west and choking up all the channels between them, up to 83° N.; but though this heavy ice bars the channels, it does not stop the flow of the current underneath, which runs into Baffin's Bay and so gets into the Atlantic Ocean; and this may have some bearing upon Dr. Nansen's current. I sincerely trust Dr. Nansen will succeed in getting into mid-current north of the New Siberian Islands, because then he will be in less danger of being impeded by all these American Islands on the one hand, and Spitzbergen and its neighbouring islands on the other, whereon are cast great quantities of Asiatic timber—trees brought down by the Siberian rivers; so I suppose as Siberian driftwood can be carried, Dr. Nansen's ship could be carried, and I hope he will come straight through. But all these dangers are very small as compared with the dangers of the ice to which he proposes to trust himself. This great Polar ice is so much heavier than that which is met with in Straits, or in Baffin's Bay, which discharge their ice annually into the Atlantic. De Long was beset in one year's ice about 6 feet thick; nearly two years later with the same ice, which had grown very much thicker round the ship, the *Jeannette* was crushed. At that time the thaw had not commenced, and the ice was still firmly frozen to her sides, so that for the ship to have been pressed up, would have been an exceedingly difficult operation. The ice imprisoned in this Polar basin for some years grows thicker from year to year. Dr. Scoresby tells us that the great ice fields in lat. 80° average in thickness 10–24 feet, and where hummocks occur it is often up to 40 feet or even 50 feet. By the crushing of the floes these great masses are pressed against each other, and overlaying, get frozen together, so that there may be almost any thickness of ice. Dr. Nansen has very fully described his ship to us, and I think she should accomplish all that any vessel could do. He attaches much importance to the wedge shape of the vessel under water, where the ice pressure will tend to lift her up. My own last Arctic vessel the *Fox* was precisely of that build: and the rotten ice, not more than a foot above the surface of the water in summer-time, would crush against her sides, pass under her, and still crushing against the wedge-shaped bottom, tend to lift her up, and so she frequently escaped from being crushed. I am glad to say she was never squeezed by the ice during the winter months, when the ice was of quite a different character—more like rock frozen fast to the ship's side. The possibility of sliding up on to the ice is then, I think, very remote. Dr. Nansen has alluded to his boats, 29 feet long, as being convenient for the reception of his men on the ice. I would prefer much more portable boats, such as could be readily and quickly removed from any position of danger; for these floes are so frequently rushing against each other and crushing together, that what is safe at one moment may half an hour afterwards be extremely unsafe; it is better, therefore, to have portable boats, and I would trust to snow huts built upon the ice, for shelter in the extreme cold. While I wish Dr. Nansen complete and speedy success, it will be a great relief to his many friends in England when he returns; and more particularly to those who have had some experience of the dangers at all times inseparable from ice navigation, even in regions not quite so far north.

Admiral Sir GEORGE NARES: It is a delicate duty to criticise the details of any voyage fully determined on, and is especially so in regard to an exploring voyage to be undertaken by another nation. But as Dr. Nansen has submitted his programme to this Society, the Arctic members are bound to give you

their opinion. In anything I say Dr. Nansen may be sure that it is said in a friendly spirit, with the greatest admiration of his plucky proposal, and his powers of endurance and readiness of resource under extreme circumstances, as displayed in the past. I would also say at once that, whatever the result of the voyage may be, we are satisfied that he will give us on his return a good account of such parts of the Polar area as he may reach. The adopted Arctic axioms for successfully navigating an icy region are, that it is absolutely necessary to keep close to a coast-line, and that the farther we advance from civilisation the more desirable is it to insure a reasonably safe line of retreat. Totally disregarding these, the ruling principle of the voyage is that the vessel—on which, if the voyage is any way successful, the sole future hope of the party will depend—is to be pushed deliberately into the pack-ice. Thus her commander—in lieu of retaining any power over her future movements—will be forced to submit to be drifted helplessly about, in agreement with the natural movements of the ice in which he is imprisoned. Supposing the ocean currents are as stated, the time calculated as necessary to drift with the pack across the Polar area is several years, during which time, unless new lands are met with, the ice near the vessel will certainly never be quiet, and the vessel herself never free from danger of being crushed by ice pressure. To guard against this the vessel is said to be unusually strong, and of a special form to enable her to rise when the ice presses against her sides. This idea is no novelty whatever; but when once frozen into the Polar pack the form of the vessel goes for nothing. She is hermetically sealed to, and forms a part of the ice-block surrounding her. The form of the ship is for all practical purposes the form of the block of ice in which she is frozen. This is a matter of the first importance, for there is no record of a vessel frozen into the Polar pack having been disconnected from the ice, and so rendered capable of rising under pressure as a separate body detached from the ice-block, even in the height of summer. In the event of the destruction of the vessel, the boats—necessarily fully stored, not only for retreat, but for continuing the voyage—are to be available. This is well in theory, but extremely difficult to arrange for in practice. Preparation to abandon the vessel is the one thing that gives us the most anxiety. To place boats, &c., on the ice packed ready for use involves the danger of being separated from them by a movement of the ice, or of losing them altogether should a sudden opening occur. If we merely have everything handy for heaving over the side, the emergency may be so sudden that we have not time to save anything. So the only feasible plan is to arrange for sledges, boats, stores, &c., to be as accessible as possible, and, in the words of De Long, "Stick to the ship as long as she will stick to us, and when she is ready to leave us try to be a little readier to leave her." As to the direction of drift of the Polar ice we all agree with Dr. Nansen as to the southerly movement of the water between Spitzbergen and Greenland. We may, therefore, accept the homeward carrying current on which he proposes finally to depend. He has, in my opinion, overstated its depth; but that does not in the least affect his main deductions. We may also infer that a similar movement of the water, with a reducing velocity, will be met with north and north-east of Spitzbergen for a distance of 500 or 600 miles—that is, to about as far as the Pole itself. Of the other water movements, there is the current from the Atlantic towards the Barents Sea. This is proved by the drift of Weyprecht and Payer to be so slight that it was completely overpowered by the wind pressure. The wind it was that carried them to Franz-Josef Land. Again, the reported Bering Strait current has so slight an effect along the Siberian coast that De Long—in the *Jeannette*, and while retreating south over the ice—was similarly drifted about by the prevailing winds, and by them

only. De Long frequently refers to the fact, and his final record left on the ice after the vessel disappeared states—"As the prevailing winds are from the south-east, this ancient ice moves slowly along to the north-west. There are no currents which are not caused by the wind prevailing at the time." There remains for consideration the effect of the fresh water discharge from the rivers. This, doubtless, exerts an influence some distance seaward, but only during the summer and autumn; and even then the largest cannot cause any appreciable movement in the ice farther than about 200 miles from the mouth. Beyond this distance seaward, the wind-drift must overpower that produced by any other means. As to the probable direction of the drift, the *Fram*, starting from near the mouth of the Lena river, may expect to meet the main pack no farther north than about lat. 76° 30′. I doubt her getting farther north before she is beset; but, taking an extreme case, and giving her 60 miles more, she will then only be in the same latitude as Cape Chelyuskin—730 miles from the Pole, and about 600 miles from my supposed limit of the effective homeward carrying ocean current. After a close study of all the information we possess, I think the wind will be more likely to drift her towards the west than towards the east. With an ice-encumbered sea north of her, and more open water or newly-made ice to the southward, the chances are small for a northerly drift, at all events, at first; and, afterwards, I know of no natural forces that will carry the vessel in any reasonable time much farther from the Siberian coast than the *Jeannette* was carried, and, during the whole of this time, unless protected by newly-discovered lands, she will be to all intents and purposes immovably sealed up in the pack and exposed to its well-known dangers. There is no doubt that there is an ocean connection across the area proposed to be explored. In conclusion, I join with Dr. Nansen in considering that the principal aim of all such voyages is to explore the unknown Polar regions, not to reach exactly that mathematical point in which the axis of our globe has its northern termination, and I offer him my hearty wishes for a successful voyage.

Admiral Sir E. Inglefield: After the remarks made by the distinguished Arctic navigators who have just spoken there is little for me to say. I think I can give Dr. Nansen a word of encouragement by telling him that on my second voyage I walked up one shore of Wellington Channel to meet Sir Edward Belcher, and one evening we were lucky in finding a pine tree one foot in diameter, and about—as far as I can remember—15 to 16 feet long, with the bark upon it, and very little bruised. We know it can have come from no other part of the world but Siberia. I may add that a portion of the bark of that tree was brought home, and the naturalist with a microscope discovered seeds and matter upon it which assured him it had not been more than a few months in the water. This was on the western shore of Wellington Channel, which, as everyone knows, runs into Baffin's Bay. I made three voyages to Beachy Islands, &c., the first in a little yacht of 150 tons, the others in Government vessels of 800 tons; and I may say that if I had to go again I would prefer the 150-ton vessel.

Sir Allen Young: I am called upon unexpectedly to say a few words, and really after what we have heard from Sir Leopold M'Clintock and Sir George Nares there is little left to say. I believe there can be no doubt that these relics from the *Jeannette* were genuine, and must have drifted on the floe on to which they were thrown when the ship was abandoned, and could have come to the Greenland coast in the time, by no other way but across the Pole, or nearly so. Dr. Nansen assumes that the blank space around the axis of the earth to be a pool of water or ice; I think the great danger to contend with will be the land in nearly every direction near the Pole. Most previous navigators seem to have continued seeing land again and again further and further north. These *Jeannette* relics may have

drifted through narrow channels, and thus finally arrived at their destination; and, I think it would be an extremely dangerous thing for the ship to drift through them, where she might impinge upon the land and be kept for years. It is only to be hoped that Dr. Nansen will be equipped with such gear as to enable him in case of disaster to retreat to open water; and I quite agree with Sir Leopold M'Clintock that these large boats will not be available for that purpose. With reference to land about the Pole I may mention that when I was at Upernavik on the west coast of Greenland, the Governor had a reindeer skin which had been branded with a mark like those which the Siberians use for their tame reindeer, and tame reindeers are unknown in Greenland; therefore this reindeer must have come from the coast of Siberia, either round the north point of Greenland or across the inland ice. It must have come across islands stretching from some point in Siberia; and this goes to prove that there are islands on the way. We know, of course, that the Gulf Stream washes the shores of Norway, and also Novaya Zemlya, and turns again to the westward, as is evidenced by the fact that glass balls used by the Norwegian fishing-boats are found on the west coast of Greenland. It reaches, perhaps, to Franz Josef Land; but further we know nothing save from the relics of the *Jeannette*, which afford strong proof of the existence of such a current. Dr. Nansen says that the *Jeannette* was not a strong ship. I am glad to say that I found the *Pandora*, as she then was named, an extremely strong ship. We had some severe nips, and yet the ice did not come through her, although on one occasion some of her beams were broken. In my opinion she was too strong; for had she not been so strong she would have been crushed in the first winter, and those heroic men who have gone and whose loss we all deplore, would have been still with us. I do not think the form of the ship is any great point; for when a ship is fairly nipped the question is if there is any swell or movement of the ice to lift the ship. If there is no swell, the ice must go through her whatever she is made of. The great danger to the *Fram* is in case she is impinged against some land and there remains. I hope Dr. Nansen will start from the west of the New Siberian Islands, because island after island were discovered by the *Jeannette*, and if he commences his drift from the north or north-west of these islands, he will start on a fairer basis than from the eastward. I only wish Dr. Nansen a most happy voyage, and that he may get through, and soon be with us again.

Captain WIGGINS: It is so late that I cannot say all I should like to say upon this most interesting question of Dr. Nansen and his glorious scheme. It gives me great pleasure to meet Dr. Nansen for the first time. I have never had the pleasure of shaking hands with him yet, but I shall not allow him to leave this platform until I do. I should have liked to have seen the track shown on the chart; I understood he was to go by Bering Strait and to the north of the New Siberian Islands in the track of the *Jeannette*. With such a route I could not see my way clear to say one word in favour of Dr. Nansen's adventurous voyage. I have heard since from his own lips that he rather contemplates going by waters nearer home, and what is of more importance, taking up what I recommended in 1876, the route inside Novaya Zemlya through to the Kara Sea, thus taking the full swing of the Gulf Stream, which we know flows in there with great force and regularity; and it must go somewhere. To those seas I have been seven or eight voyages, and never yet returned on account of ice. The thermometer there shows us 45° to 50° Fahr. in the water passing through the Straits. I cannot to-night say one-half of what I should like to say, but if I could have the honour of doing what I have never done in this room—reading a paper—I could, in an hour and a half, make it very clear that it might not be impossible to take the ice and cross the regions of the Pole, if not the Pole itself. As I pointed out in 1876, I found open water all the

way to Dickson's Harbour in 1874–75, and I believed the best course to the Pole would be through the Kara Sea, not further east than the Chelyuskin promontory, i.e., 100° long. The only risk will be, as Sir Allen Young pointed out, the question of land. No doubt land will be found distributed about the Pole more or less, even shoals. It has been found before, not only by the *Jeannette*, but by the Austrian expedition in the *Tegetthoff*, which I had the honour of searching for in 1874 in the *Diana;* and when I found them at Hammerfest they acknowledged I was quite right in advising them to go inside the Kara Sea. I felt certain the best currents were there; and along the Siberian shore there are always natives who could help. De Long did not lose his life for want of natives, but by exposure in the boats; he perished at the mouth of the Lena by the storms; the two men who escaped easily found the natives. I would advise Dr. Nansen not to take the New Siberian Islands, as they are most treacherous, low, sandy, muddy, horrible places, and on account of the Lena, there is broken water all the year round, and that is bad for sledging. Baron Wrangel found open water there in midwinter. With regard to going on the top of the ice I am at one with Dr. Nansen, the only difference being that I believe in small things. I did my first voyages in the *Diana* of 120 tons, and was crushed upon the top of the ice, and in my ignorance, in 1874, rammed the ice in splendid style, and had some hair-breadth escapes, having entered the Kara Sea too early in June and July. I should recommend instead of so large a vessel a smaller one, or to take a small one with him, as with a small vessel you can do much more on the top of ice than with a large one. A vessel may rise when it is squeezed by the ice, though the chances are much against it. The *Tegetthoff* rose until her keel was on top of the ice, like the model of a steamer on a table. I should recommend, if there is room, not to wait for a squeeze, but to run the vessel as far on top of the ice as possible. A small vessel of 20 or 30 tons might be easily hove round a headland like a huge sledge on the top of ice-floes. If I were going now I would take three small vessels—or at any rate two—as being better than one big one. I should recommend Dr. Nansen to go through the Kara Sea, and on the 100th parallel the current would be always with you. I wish him God speed.

Captain WHARTON, R.N.: At this late hour I will say a very few words. As I have not Arctic experience I suppose I am called upon as the professional guardian of the currents of the world, and all I can say on that point is that so far as Dr. Nansen has spoken about the currents that are known he is correct. He speaks of articles thrown upon the coast of Greenland: that is according to fact. As regards the ice I cannot tell you anything. I believe, after close investigation into known currents, that Dr. Nansen is quite justified in supposing there is a drift from the New Siberian Islands, or that side to Greenland, but as to its direction or speed that, as he has told us, is pure speculation. He is not going into this matter with his eyes shut. He has argued the question out very closely, and given us an admirable paper. People sometimes ask, What is the use of Arctic exploration? Amongst other things I think it may be said that its use is to foster enterprise and bring gallant men to the front. To-night we have an excellent example of that in Dr. Nansen. I can only say to him, "God speed."

The PRESIDENT: It is very late, and although there are still many eminent Arctic travellers present—Admiral Ommanney, Dr. Rae, and others—I think it will not be your wish to hear any further speakers. I ought to mention, however, that I have received a long letter—too long to read—from Sir George Richards on this subject; and, although admiring Dr. Nansen, he is obliged to speak unfavourably of his project, adding that anyone speaking with authority ought to speak out when so much is at stake. Dr. Nansen will perhaps like to answer in a few words, and then the meeting will close.

Dr. NANSEN: I use this opportunity to express my most hearty thanks to those eminent Arctic men who have given their opinions and criticism upon my scheme to-night. I must, at the same time, say that I could get no better encouragement for my expedition, because their criticism has not been able to convince me that I am wrong in my opinion about the currents or about the expedition. Sir Leopold McClintock, Sir George Nares, and Sir Allen Young say that it would be impossible for the ship to be lifted during the winter, but that it would be frozen in. Well, I will not detain you by giving you my opinions about that, but will only say that we have, as Captain Wiggins mentioned, one very good instance of a ship being lifted during the winter, viz., the *Tegetthoff*. She was lifted so high that her keel was above the surface of the ice. That, in my opinion, is enough to prove that the vessel can be lifted even in the winter, and that she may drift in the ice for years without being crushed, if she is only strong enough to withstand the pressure necessary to lift her. The *Tegetthoff* indeed, was safe when she was deserted because of the fear that she would not move again. It is also maintained that my boats are too heavy; but I had not the time to read all about the equipment of the expedition, or I could have told you that I am going to carry about ten boats of various sizes, and some of these will be exceedingly light. Of course, the heavy boats are only to be placed on the ice for living in, because the small boats are too small to live in comfortably. Sir George Nares said he thought an Arctic expedition should always secure a line of retreat. I am of the opposite opinion. During my expedition to Greenland I proved that it is quite possible to accomplish something when you have no retreat, for we then burned our ships behind us, and, in spite of it, got across Greenland; and I hope to be as successful when we break the bridge behind us this time, if no other circumstances intervene to prevent us from getting through. Sir George also referred to the great risk run by the boats through floating ice. I refer you to the experience of the *Hansa* Expedition. They kept their boats for a whole winter drifting south along the east coast of Greenland, and when the hut they built of their coal was broken by the breaking up of the ice they took refuge in their boats, sleeping on board during the nights for safety; so I do not think it impossible to keep boats safe on the ice if you only take proper care of them. This was also my experience in drifting along the East Coast, and we had some bad experiences. The worst thing in that respect is, in my opinion, not the ice, but the surf, and we run no risk of that in the Arctic regions when surrounded by ice. As to the winds:—I mentioned in my paper, that according to my opinion the winds will not be against us, but in favour of my scheme; in fact, the wind is the principal cause of the currents, and if we can say with certainty that a definite current is constantly running in a distinct direction, we may as a rule conclude that the average direction of the winds go the same way; but I think we need not go further into this question at present, as we actually know very little of the winds in the unknown Arctic regions; the only experiences of much importance in this respect are those of the *Tegetthoff* and the *Jeannette*, and they do not seem to speak in my disfavour. In my opinion Sir George Nares was not able to prove that my arguments for the existence of such a current as I assume were wrong. Sir Edward Inglefield was kind enough to mention the finding of drift-wood from Siberia on the shores of Wellington Channel coming from the north. So long as that and similar evidences are undeniable facts, I think it shows that there must be ice constantly floating across, as the drift-wood cannot dive under the ice. As regards the ice conditions, at the New Siberian Islands I have received some information from Baron von Toll, who has spent two years there, and I regret time will not allow me to give you details; but the sense of it is that the sea generally is open to the west of the New Siberian Islands during August. How far north that prevails nobody

knows, but in my opinion it cannot be a short distance, as the River Lena sends out a quantity of fresh warm water during the summer into the shallow Polar Sea, and produces a current running north. I thank Sir Edward most heartily for the proof of the current he has given. I quite agree with Sir Allen Young that one of the greatest risks is to meet land, and as I said in my paper it is very likely that we will meet land further north. The *Tegetthoff* expedition was stopped by land, but I do not think that such a thing is likely to happen very often; if there is land in the north it is, of course, quite possible that we may drift against it, but the probability is that the current shall carry us past it, as it does with most part of the ice; and this will become the more certain if we get into the heart of the current; but if we are stopped we have nothing to do but to leave the ship and travel on with the current. If we only keep with the current and do not go against it I do not think it impossible to reach open water and get home in that way. I must thank Captain Wiggins for his most interesting remarks, but I must say I never thought of taking the *Jeannette* route; my idea was at first to go through Bering Strait and along the Siberian coast to the New Siberian Islands, and thence go north, as I thought that it would be easier to reach these Islands that way than through the Kara Sea and past Cape Chelyuskin. By examining the question more closely, I have come to the conclusion that the advantage of this first route is not quite certain; and then, of course, I prefer the shorter one through the Kara Sea. I quite agree with Captain Wiggins that the best route to follow is to keep as much to the coast as possible; therefore my ship was made to draw as little water as possible in order to be able to travel inside the ice along that shallow coast. Captain Wiggins recommended a small ship; I think a ship 29 feet long ought to be small enough, and I have two such small ships. I will conclude by thanking the Geographical Society and the English Arctic explorers for the cordial way in which they have received me and my scheme.

The PRESIDENT: You have listened to Dr. Nansen, you have admired his foresight in anticipating and providing against difficulties, his resource, his ingenuity in details, his courage and his enthusiasm. You have heard the views of some of our greatest Arctic authorities. The views of some others which there has not been time to read, including those of Sir Joseph Hooker, whose experience was gained in the Antarctic regions, and as I have already mentioned, those of Sir George Richards will be laid before you in *The Geographical Journal*. Dr. Nansen will no doubt reflect upon what has been said and written, but for the members of the society at large to pronounce any definite opinion upon such keenly-disputed questions as are involved in Dr. Nansen's plans would be out of the question; what we can do is to assure him of our most cordial good wishes and to give him as I now do our warmest thanks for his paper.

The following communications have been received from Admiral Sir George H. Richards and Sir Joseph D. Hooker, who were unable to be present at the meeting:—

I venture to offer a few brief remarks on the paper which has been read by the distinguished Greenland traveller and explorer, Dr. Nansen. Dr. Nansen, in his paper, deals mainly with the currents, known and unknown, in the Arctic regions, and he appears to trust almost entirely to their influence for the accomplishment of his object in reaching the Pole, or rather in being drifted from a position near to the New Siberian Islands, across the Pole to Greenland, a distance, in a direct line, of about 1400 miles. Now to make myself clear I must give in a few words my views of these currents. I believe that there is a constant outflow (I

prefer this word to current) from the north in consequence of the displacement of the water from the region of the Pole by the ice-cap which covers it, intensified in its density by the enormous weight of snow accumulated on its surface; this outflow is doubtless more pronounced in the portion of the Arctic Circle between the west end of the Parry Isles and Spitzbergen, where the numerous groups of islands cut it up into narrow straits and passages which form so many ducts for its escape to the south. Over the other portion of the Circle which we know less about, and which embraces a far larger extent of sea, it is doubtless less pronounced in a southerly direction, and there is no decided current through Bering Strait one way or the other, which is probably owing to the very shallow water (less than 20 fathoms) for a considerable distance on either side of its entrance; Bering Strait is the only outlet on that side of the Pole.

Now this general southerly outflow which I have mentioned is of a very weak character, considered as a current, and every ship which has ever penetrated north has had to do so against it, and has found no difficulty in doing so while there has been sufficiently open water or loose ice to make steam or sail power available; when this has not been the case, and a ship has not got within the inner waters before the new ice of autumn is formed, she is certain to be carried back by this outflow by slow degrees with the ice, and to reach the open water probably early in the spring. I cannot find any reason for believing that a current sets north over the Pole from the New Siberian Islands which Dr. Nansen hopes for and believes in. Dr. Nansen, I think, calculates it at about 2 miles a day; there is nothing in the *Jeannette* expedition to support such a theory; she made something like 900 miles from Bering Strait in nearly two years, in a direction north of west, or nearly with the line of coast, and was then crushed near the position where Dr. Nansen's current commences.

It is my opinion that when really within what may be called the inner circle, say about 78° of latitude, there is little current of any kind that would influence a ship in the close ice that must be expected; it is when we get outside this circle, round the corners as it were, into the straight wide channels, where the ice is loose, that we are really affected by its influence, and here the ice gets naturally thinner and more decayed in autumn, and less dangerous to a ship. Within the inner circle probably not much of the ice escapes; it becomes older and heavier every year, and in all probability blocks the navigation of ships entirely. This is the kind of ice which was brought to Nares' winter quarters at the head of Smith Sound, in about 82° 30′ north, and this is the ice which Markham struggled against in his sledge journey, and against which no human power could prevail.

I must not omit to allude very briefly to the only tangible evidence which Dr. Nansen brings in support of his currents, viz., the articles said to have been found in Greenland belonging to the *Jeannette*. I don't for a moment impute any bad faith to the authors of this story, nor do I include it among the many fables which have been rife since the Franklin Expedition, most of them made to order as marketable articles, but I attach no real importance to it. If found in Greenland they may well have drifted down on a floe from the neighbourhood of Smith Sound, from some of the American Expeditions which went to Greely's rescue. It may also well be that some of "De Long's" printed or written documents, in regard to his equipment, may have been taken out by these Expeditions, and the same may apply to the other articles. But even if it were possible to accept this evidence it would only mean that a piece of ice with these relics had been coach-wheeled in some way round the polar basin to Greenland in three years, and could not afford a very encouraging hope for Dr. Nansen's ship. I regret to have to speak discouragingly of this project, but I think that any one who can speak with authority, ought to speak plainly

where so much may be at stake. I have always rested my hope of the North Pole or its neighbourhood being reached by sledge journeys along the land ice, north of Smith Sound. The expedition of 1875, however, under Nares dissipated this hope by proving the improbability of any land at a convenient distance in that direction, and if this is so, there remains only the possibility of its accomplishment by ship navigation. I confess that I have never been an advocate of amateur nautical expeditions for such service as this; and for obvious reasons. It must be admitted, however, that they have one advantage; their anxieties are not added to by the knowledge that they become the objects of rescue almost before they are well into the regions of danger.

In Government Expeditions, especially from this country, the excessive caution which it is perhaps necessary to insist on to ensure the certainty of a safe retreat, demands a system of supports which fetters the action of the commander, and by separating his ships during winter, deprives him virtually of half his travelling force in early spring. Such reasons will probably be a bar to any Government Arctic enterprise for many years to come; whatever may be undertaken in the Antarctic region, which is virgin ground, and where the conditions are probably so different, that it may not be necessary to pass a winter, at any rate where a reconnaissance would first be made. The solution of the Polar problem, if it is ever solved, may therefore possibly be effected by some such effort as the present one.

All British Arctic men will, I believe, hope that Dr. Nansen may be the successful explorer, and that he may reap the reward due to his pluck and enterprise. They will certainly welcome him home, successful or unsuccessful, long before the expiration of the almost countless years for which he is prepared to persevere. I think he is very wise to commence his voyage by way of the Kara Sea, instead of by Bering Strait, to reach which and get on the threshold of his labours a voyage of about 20,000 miles must first be accomplished. By adopting Nordenskiold's course he is certain at any rate to add something to our knowledge of these little-known regions.—GEORGE HENRY RICHARDS.

In compliance with your request, I have carefully studied Dr. Nansen's able and clear statement of his reasons for adopting the course he has chosen for reaching the hitherto unexplored Arctic area, and his preparations for its accomplishment.

Dr. Nansen's project is a wide departure from any hitherto put in practice for the purpose of Polar discovery, and it demands the closest scrutiny, both on this account and because it is one involving the greatest peril. The following considerations respecting it have occurred to me.

From my experience of three seasons in the Antarctic regions I do not think that a ship, of whatever build, could long resist destruction if committed to the movements of the pack in the Polar regions. One built as strongly as the *Fram* would no doubt resist great pressures in the open pack, but not any pressure or repeated pressures, and still less the thrust of the pack if driven with or by it against land. The "lines" of the *Fram* might be of service so long as she was on an even keel, or in ice of no great height above the water-line, but amongst floes and bergs, or when thrown on her beam-ends, they would avail her nothing.

The contingency of the *Fram* being, by a divergence of the assumed currents, stranded on the north coast of Greenland, or of the American Polar Islands, or elsewhere, should be taken into account. Assuming that a landing could be effected, it must be on an inhospitable and probably ice-bound coast, or on the mountainous ice of a palæocrystic sea. With a certainly enfeebled, and probably

reduced ship's company, there could, in such a case, be no prospect of reaching succour.

Putting aside the possibility of scurvy (against which there is no certain prophylactic), have the depressing influences on the minds of the crew, resulting from long confinement in very close quarters during many months of darkness, extreme cold, inaction, ennui, constant peril, and the haunting uncertainty as to the future, been sufficiently taken into account? Perfunctory duties and occupations do not avert the effects of these conditions; they hardly mitigate them, and have been known to aggravate them.

I do not consider the attainment of Dr. Nansen's object by the means at his disposal to be impossible; but I do consider that the success of such an enterprise would not justify the exposure of valuable lives for its attainment; and I may conclude with expressing the hope that Dr. Nansen may dispose of his admirable courage, skill, and resources in the prosecution of some less perilous attempts to solve the mystery of the Arctic Area.—Jos. D. Hooker.

EXPLORATION AND CHARACTER OF THE PRINCIPAL NEW ZEALAND GLACIERS.*

By A. P. HARPER, Hon. Sec. New Zealand Alpine Society.

The broad features of the mountain system of the South Island of New Zealand are tolerably well known, and need only be briefly referred to here. Beginning at the north end of the South Island, we find, in Nelson and Marlborough Provinces, numerous ranges spreading from coast to coast, and reaching in many instances to over 8000 feet. They include some grand peaks, on which snow is to be seen during most of the year, while the lower spurs are clothed in luxuriant forest, of which a considerable area has been "cleared" and brought under cultivation. Further south these ranges draw together, till, in the Southern Alps, they form a great mountain wall, running from N.E. to S.W., which sends off a number of spurs rising into bold Alpine peaks, and for upwards of 100 miles presents a snowy barrier, crossed last season for the first time, by a pass lying at the head of the Godley Glacier, in the north-east of the district embraced by the map.

To the eastward the Southern Alps send out great buttresses, terminating suddenly in the broad Canterbury and Mackenzie plains, which form, by their absolute flatness, a striking contrast to the peaks behind; while westward the mountains slope rapidly, and in many cases fall in sheer precipices for some thousands of feet to the coast, leaving about 10 miles of comparatively level country between them and the sea.

To the south, in Otago, we find the chain spreading out again from coast to coast in lower hills, amongst which are flourishing farms and

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* Map, p. 96.

sheep stations. Amongst the Otago hills lies the beautiful lake district where Lakes Wakitipu, Te Anau, and Wanaka, are backed by Mounts Aspiring, Earnslaw, and other fine Alpine summits, reaching a height of nearly 10,000 feet. This part of the island also includes the now well-known sounds, or fjords, in which several small glaciers are to be found, and round which the mountains tower precipitously to heights ranging from 3000 to 8000 feet. In the south-west corner, below Lake Mani-pori, there is still a fairly large tract marked on the map as "unexplored," into which, however, a party was preparing to force a way last March. With this single exception all the colony has been explored and surveyed, except of course the glacier region in the High Alps, and this has been mapped from sketches and photographs. The Survey Department of the Government has always been noted for its good work, and includes some first-rate men, who have successfully coped with all kinds of difficulties.

The object of this paper, however, is not to give a general sketch of survey work of the island, but to explain to the best of my power the accompanying map, and describe the exploration of which it is a result.

Any account of the pioneer work of a young colony must needs include the doings of men who make such work their profession, as surveyors and prospectors, though there are many instances in the past and present of persons undertaking it more from the pure love of adventure than from any other reason. The smaller glaciers of the Southern Alps (lying north of the larger ones) were visited before those surrounding Mount Cook, owing to the early settlers following the rivers to their sources in the hope of opening up new sheep country, or of finding a pass to the west coast of the island—which in the early days was the subject of much speculation; several attempts were made to force a way over. This was first done in December of 1857, when Mr. Leonard Harper, with four or five Maories, reached the coast over the range, and explored it from Greymouth to Awarua River (since named Haast River), obtaining a good general view of that side of the Alps and some of the glaciers, but not actually visiting any of them. A year or two later (I believe), the glaciers at the head of the Rakaia River were visited by Messrs. Harman and Whitcombe in the course of their survey; and those of the Rangitata, further south, were visited by Messrs. Acland, Chudleigh, and W. Harper.* In addition to this, a great deal of exploring was done among the ranges further south; but as this paper deals chiefly with the Mount Cook Glaciers, it would take too much space to enter into other details.

The first record of any exploration of the larger glaciers is in 1862. It was then that Sir J. von Haast explored the head-waters of the

* See *New Zealand Alpine Journal*, No. I., p. 22.

Godley and Tasman Rivers, proceeding for a short distance on to the ice of the Godley and Classen, at the head of the former river, and of the Mueller, Tasman, and Hooker Glaciers, at the head of the last named.* In 1867 and 1870, Mr. E. P. Sealy made some long expeditions with his camera on these glaciers, in one instance reaching the watershed on the Godley, also penetrating into the upper basins of the Mueller, Hooker, and Tasman Glaciers. From that date, with one exception, there is little to record as far as exploration in this locality is concerned; and it was not till 1882 that we hear of further efforts, when the Rev. W. S. Green, with two Swiss guides, made an almost complete ascent of Mount Cook.†

In 1883, Dr. von Lendenfeldt, from Austria, made a complete exploration of the Tasman Glacier, when he reached the west coast saddle, and ascended the Hochstetter Dome (9258 feet). His experiences and observations are published in German,‡ with his map, which was excellent, though one or two mistakes in detail have since been discovered and rectified. From that date till the present there has been greater activity in this direction, as young New Zealanders began to realise that there was an undeveloped Alpine world equal to that of Switzerland, and that unless some native enterprise was shown, the credit of opening it up would fall to outside men, which would be an everlasting mark of their failure to follow in the footsteps of the early pioneers.

In 1886 Mr. G. E. Mannering set the example, and made an expedition to the Tasman, with little result, owing to his want of knowledge in Alpine work at that time;§ but he has continued every summer to visit the locality in company, on different occasions, with Messrs. M. Dixon, P. Johnson, and Inglis. His efforts were chiefly directed against Mount Cook; and in his repeated attempts on that peak, he did not add much new information as far as the map was concerned, to that already furnished by Mr. Green and von Lendenfeldt; though on one occasion he reached 8000 feet on Mount de la Bêche, thus getting a better general idea of that portion of the Tasman Glacier and its tributaries than had been obtained before. In 1889 the Government sent Mr. Brodrick, a surveyor, to the district. He executed a complete traverse and survey of the Mueller Glacier, and partial traverse and almost complete map of the Hooker Glacier, the latter being correct in all but one important point, which I shall refer to later on. The same season, however, a most important addition was made to our

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* For an account of Von Haast's work, see 'The Geology of Canterbury,' by Von Haast, and *New Zealand Alpine Journal*, No. I., p. 14.

† 'The High Alps of New Zealand.' By Rev. W. S. Green (Macmillan & Co.).

‡ 'Der Tasman Gletscher und seine Umgebung,' by von Lendenfeldt. *Petermann's Mitteilungen*, Ergänzungsheft, No. 75.

§ 'With Axe and Rope in the New Zealand Alps.' By G. E. Mannering (Longmans), 1891.

knowledge of the district by the exploration of the Murchison Glacier, lying to the east of the Malte Brun Range, and hitherto unknown beyond the fact that there was a large glacier at the head of that valley.

In January of 1890 Mannering and I, after finding a new pass of no great importance over the southern spur of Mount Cook from the Tasman to the Hooker, at the head of the Ball Glacier, decided on pushing up the Murchison, and exploring the glacier. I must refer to Mr. Mannering's book for a full account of this expedition. The immediate result of our trip was, that the Government sent Mr. Brodrick to survey the Murchison in the following December, which he did thoroughly, proving that our sketch-map was fairly correct, and at the same time completing the topographical survey of the chief glaciers on the east side of the main range.

December, 1890, was notable in our annals chiefly on account of Mannering and Dixon's successful ascent, by Green's route, to within a short distance of the summit of Mount Cook. In that year it was also proved that the map of the Hooker Glacier was incorrect as regards the position of Mount Cook, which had been placed on the main range, but was found to be in fact some little distance on the eastern side, thus sending no water to the west coast at all. This fact was suspected by Mr. Roberts on the West Coast Survey, and was finally settled by Mr. R. Blakiston and myself on our ascent of the saddle at the head of the Hooker Glacier; an ascent which had been tried three or four times by others without success. But for the fact mentioned, and for showing that St. David's Dome (Hicks) was separated from Mount Cook by Mount Dampier (Hector), this ascent was not noticeable for any further discovery.

One point I have been asked to settle from our observations on this climb, is, whether the Balfour Range is not in reality a spur of Mount Hicks instead of being, as shown in the map, an offshoot of Mount Tasman. If this were the case the upper basin of ice, shown on the map as belonging to the La Perouse Glacier, would really be part of the head of the Balfour Glacier. The question is still an open one, for owing to a fog we did not obtain a good view, and we are, I believe, the only persons who have attained a point from which it could be determined.

Last season little was done of importance. Mannering and Lean made a descent from the Godley Saddle to the head of a valley on the west coast, but owing to a mishap were unable to proceed any distance; while on the Tasman, Hamilton and I nearly ascended Mount de la Bêche, but owing to my companion's ill-health, we could not complete the ascent. We, however, overlooked for the first time the watershed at the head of the Rudolf Glacier, seeing the enormous ice and snowfields at the head of the Francis Joseph Glacier.

With the exception of one or two climbs from which no discovery of importance was made, I have now given a fairly exhaustive, though rough, history of the explorations which have helped to make up the map, as now existing, of the glaciers on the eastern side of the watershed.

The amount of work done in the corresponding country on the western slopes of the watershed is not of any great extent, as far as the glaciers are concerned. None of them have been explored; and nearly the whole survey has been filled in from sketches, &c., taken from lower ground by the Survey Officers, under Messrs. Roberts and Douglas, who are well fitted for such exploration—chiefly very rough "bush" work, carried on in an uncertain climate. The west coast is noted for its large rainfall, I believe something like 120 inches being the yearly average, while on the east coast from 25 to 30 inches is nearer the mark. The reason of this apparent want of enterprise on the part of private individuals is, that it takes several days to reach the field of action on the west coast. If one went there with the intention of crossing over to the east coast by a high Alpine pass, there would be no serious loss of time provided the attempt was successful; but any failure would necessitate a return journey along the coast to some practicable pass; and hitherto want of time has been the cause of most of our failures.

For a really successful exploration on either side of the range, a party should be composed of three or four strong men, who do not mind often sleeping in the open air on moraines, and who can afford the time to wait for favourable opportunities; as in most cases hitherto we have pushed on in the face of doubtful weather, in hopes of a change for the better, which has often resulted in an enforced retreat to our base of operations. This not only entails loss of time, but also much waste of power, because finding it difficult and very expensive to procure porters, we have to carry large "swags," or packs, which sometimes weigh 50 lbs., between one bivouac and another. The party should really be able to afford time for several trips to and fro, in order that a future bivouac may be provisioned and prepared for a stay of several days. Of course in the case of an attempt to push into new country, the whole "swag" must be taken, especially if the party expects to return another way, as in the case of the exploration of the Murchison Glacier, where, thinking we should be able to get over the Malte Brun Range into the Tasman Valley, instead of retracing our steps, we had some 30 or 40 lbs. to carry the whole three days.

I now propose to give a short description of the country delineated on the map, with some interesting measurements taken by Mr. Brodrick, who made the surveys of the eastern glacier system.

The highest point in the Southern Alps is Mount Cook, or Aorangi, as it is sometimes called, which reaches the very respectable height of

12,349 feet, and is practically the centre of the system. It lies approximately in lat. 43° 30′ S., or some little distance nearer the Equator than the Swiss mountains. In spite of this fact, however, the snow-line in this district is about 3000 feet lower than in Switzerland, and the glaciers also come to a lower level. The terminal face of the Tasman Glacier is only 2354 feet above the sea, and the Mueller and Hooker about 2500 and 2882 feet respectively, while on the west coast we find the difference still more marked; for instance, the Fox Glacier comes down as low as 700 feet, and one or two of the others to under 1300 feet, though their terminals are within 10 miles of the sea. The Fox is decidedly interesting, not only as being the lowest of all the glaciers, and, like others on this side, having tree-ferns and bush growing almost on the moraine, and in some cases overhanging the ice, but from the fact that within a very short distance of the terminal face there is a hot spring, with a temperature of over 100° Fahr. This is, I believe, almost unique, and occurs once in the North Island on Mount Ruapehu (9100 feet), where, after climbing some distance on snow and ice to the top, one finds a boiling lake in the crater, into which the ice melts.*

The great glaciers on the east side of the watershed are chiefly flat, hummocky ice, flowing gradually from heights varying from 5300 to 8600 feet. They are covered, roughly speaking, for a quarter of their length with a considerable quantity of surface moraine, formed of detached masses of rock and *débris* of all kinds, with which the Swiss moraines cannot be compared for roughness or extent; it is lifted in heaps or hillocks of 50 feet or more above the general level of the glaciers. The old lateral moraines too are most marked, especially on the Hooker, where five are distinctly visible in some places; while on the Mackenzie plains one rides for upwards of 40 miles through ancient terminal and lateral moraines, showing that at a date comparatively not very distant the glaciers must have been enormous.

The western glaciers, on the other hand, are very different in character, being far steeper, and practically icefalls to within a short distance of their lower ends. They are also almost entirely free from surface moraine, a fact easily accounted for, since the strata in the rocks dip steeply toward this coast, thus presenting a smooth surface on the west, and on the east a broken face, which under the action of weather and climate send down vast masses of *débris* on to the glaciers. Of the upper peaks and ridges comparatively little is known from actual ascents, for owing to difficulty in carrying supplies, and the roughness of the approaches, we have frequently had to return to the head camp because we cannot provide and hold out against bad weather for any number of days, thus losing much valuable time on

* See *Proceedings*, 1885, p. 272.

the lower ground. This no doubt will soon be remedied, as we are gradually making snug bivouacs in which to stay during the bad weather if necessary, and also owing to the fact that the Government have given us a hut at the junction of the Ball and Tasman Glaciers, which is a capital place for a base of operations.

On the main range the only peak of importance which has been ascended is the Hochstetter Dome (9258 feet). It was first climbed in 1883 by von Lendenfeldt's party, and has since been climbed on two occasions. Also, four saddles have been successfully reached, namely, the Godley Saddle, reached by Sealy, in 1869, and crossed in 1892 by Mannering and Lean for a short distance towards the west coast; the saddle at the head of the Tasman by von Lendenfeldt; that at the head of the Hooker by Blakiston and myself; and on the Mueller, the Burron Saddle, in 1889, by Brodrick's survey party.

Off the main range, a point at 8000 feet has been reached by Brodrick's survey party in 1890, on the Liebig Range; a pass of about 8000 feet, at the head of the Onslow Glacier, on the Malte Brun Range, by Johnson and myself in the same year; and also a point about 7700 feet on Mount Darwin, by Hamilton and myself in 1892. On the Mount Cook Range the main peak of 12,349 feet has been ascended, to within a few feet of the top, by Green in 1882 and Mannering and Dixon in 1890; a pass over the southern arête, at the head of the Ball Glacier, by Mannering and myself in 1889, from the Tasman to the Hooker; and some minor peaks under 7000 feet, to the south of the pass by the survey party and others; on the Sealy Range, Mount Sealy, 8600 feet, has been ascended to about 7900 feet by M. Ross in 1889, and to about 8100 by Johnson and myself in 1890. These represent, roughly, the principal climbs done in this district, and it will be seen that only one peak has actually been conquered. All the others, from Mount Cook downwards, which are mentioned are only partial ascents, the failures of which may be put down to loss of time on the lower ground; bad weather either on the peak or on the glacier causing a retreat from a bivouac to the head camp; and in three cases owing to illness of one of the party, brought on by excessive work in the first place before reaching the scene of actual climbing.

To compare the mountains with the Swiss Alps would be difficult, except in general appearance. Briefly we have, in my opinion, no rock peaks equal to the Matterhorn or Dent Blanche for grandeur, while, on the other hand, I think that in snow peaks in Tasman, Haidinger, Sefton, and Mount Cook, we can more than hold our own, both for beauty and difficulty in climbing; though the latter point is one which has to be proved by actual experiment, as, except Mounts Cook and De la Bêche, none of the loftier peaks have been attempted.

From a scientific point of view our glaciers are very interesting, and I think I cannot do better than make extracts from the Government

Survey report of 1891, which contains the result of Brodrick's observation and survey.*

The glaciers are on the whole receding; in some cases, such as those at the head of the Rangitata River, very rapidly, in others, such as the larger glaciers, more slowly. In the former case, which, so far as we know, is the most marked in this respect, Mr. J. B. Acland gives some interesting measurements, taken at the terminals of the Clyde Glacier. In 1866 the altitude at the terminal face was 3233 feet, and the point where the clear ice was lost in the surface moraine was 1057 feet higher. The next year this point was 980 feet above the terminal, and in 1871 only 725 feet, thus showing a shrinkage of 305 feet in altitude in five years between the two points. In 1880 he again visited the locality, but took no measurements, but reports that the shrinkage was very evident.†

The very marked moraine heaps, which must have been terminal moraines at no very distant date, are further evidence of shrinkage; and these exist in great numbers in the neighbourhood of the Tasman and Hooker Glaciers. The Mueller Glacier, however, is so erratic, that it is hard to say whether it may not be advancing. Last year it pushed forwards several yards, damming up the Hooker River; and meeting great resistance, its terminal face was thrown up into enormous hummocks and pinnacles of 200 feet. The Ball Glacier has advanced also very noticeably in the last few years.

Mr. Brodrick's observations and report give the following results as to the size, extent, and motion of the four chief glaciers—namely, those on the eastern side of the range—in the accompanying map.

Name.	Area.	Length.	Average Width.	Greatest Width.	Narrowest Width.
	Acres.	Mls. Chns.	Mls. Chns.	Mls. Chns.	Mls. Chns.
Tasman	13,664	18 0	1 15	2 14	0 60
Murchison . . .	5,800	11 0	0 $66\frac{7}{10}$	1 5	0 42
Mueller	3,200	8 0	0 50	0 61	0 37
Hooker	2,416	7 25	0 $41\frac{3}{10}$	0 54	0 30

He also adds the Godley and Classen, which, as I have said, lie to the north-east of the district included in the map, and are at the head of the Godley River and Lake Tekapo.

	Acres.	Length.	Average Width.
Godley	5,312	8 miles.	1 mile 3 chains.
Classen	1,707	4 miles 70 chains.	$43\frac{3}{4}$ chains.

* 'Reports of the Survey Department, New Zealand,' 1888–89, 1889–90, 1890–91. Survey Office, Wellington, N.Z.

† See *New Zealand Alpine Journal*, No. I., p. 22.

These figures show that our glaciers exceed in extent those of Switzerland, the Aletsch being only 15 miles long by nearly 1 mile broad.

In estimating the rates of motion, Mr. Brodrick set rods in a line across the glacier, taking fixed points on the two sides, allowing a certain time to elapse before noting the alteration, and then taking an average per day. On the Tasman, one line extended across from near the inflow of the Ball Glacier, 8 rods being set on December 5th, 1889, and re-set again on January 7th, 1890, showing the following result:—

	Total Movement.	Daily Rate.
Station 1	27·2 feet.	9·9 inches.
,, 2	41·0 ,,	14·9 ,,
,, 3	47·7 ,,	17·3 ,,
,, 4	48·4 ,,	17·6 ,,
,, 5	49·6 ,,	18·0 ,,
,, 6	46·9 ,,	17·0 ,,
,, 7	44·2 ,,	16·1 ,,
,, 8	38·3 ,,	13·9 ,,

The other line taken was from the point of the spur running down from Malte Brun Range, on the northern side of the mouth of the Murchison Valley, being set and re-set on the same dates. The measurements were taken from nine points, showing respectively the following results in total movement:—6·5 feet, 25·9 feet, 28·7 feet, 32·7 feet, 36·6 feet, 33·7 feet, 34·4 feet, 29 feet, 25·4 feet, 13·9 feet; while the average daily rate is easy to calculate, ranging from 2·4 inches to 13·3 inches, and down again to 5 inches. On the Murchison he observed a set of rods across from the Dixon Glacier, showing an average daily rate, calculated from 48 hours' observation, of 0·5 inch, 3·5 inches, 8·0 inches, 8·7 inches, 7 inches, 4·5 inches, and 2·6 inches respectively at the different rods.

The Hooker, contrary to the opinion of those who have traversed it, shows very little motion, which is peculiar, because the head ice is steep when compared to the others, and it descends about 6000 feet in $7\frac{1}{4}$ miles. The figures given were determined in the same manner after a lapse of three days from taking the first line. The average daily rate is, for the 5 rods:—1·1 inch, 2·9 inches, 4·2 inches, 5·4 inches, 4·5 inches respectively.

The Mueller was subjected to a much more trustworthy test, as the first line was taken on March 29th, 1889, and on November 14th, 1890, thus allowing two winters and one summer to elapse, while the others, as will be seen, were only summer motion. Eleven fixed points show the following result as to average daily rate:—4·8 inches, 5·5 inches, 5·8 inches, 7·3 inches, 8 inches, 12·3 inches, 10·2 inches, 8·2 inches, 7·8 inches, 2·9 inches.

In finishing his report, which I have quoted less than I should have wished, Mr. Brodrick says: "I have now been over all the most

important glaciers of Canterbury, and a great many of the smaller ones as well, but I should say that the Murchison, for reasons I shall try to enumerate, is the best field for scientific research. To begin with, its moraine is composed of different-coloured stones lying in sections. . . . From the many views I have had of the glacier from different points on the surrounding hills, I have always been able to distinguish this feature; . . . the large medial moraine is smoother than any I have seen on other glaciers, and for some distance a horse might be ridden along it. The height is from 60 to 90 feet, and the stones are in general small. The general appearance of a section would be like that of a formed road —that is, a gradual rise to and a slightly flattened crown.

"Between this moraine and the spur north of the Dixon Glacier a large surface stream runs, finding its way under the glacier, but by no fixed opening. . . . It is swift, and many perfectly water-worn stones are in its bed.

"Water-worn stones are to be found throughout the whole length of the main moraine, but, so far as I could see, only on the eastern side. To get from the bed of the creek to the place I have indicated the stones would have to be lifted about 100 feet; yet I believe that is the place they came from, and I think the Dixon Glacier in some manner pushes the ice up."

Of the tributary glaciers he says the Baker and Dixon are advancing decidedly, while the Wheeler and Cascade are dying out. The two former have a peculiar ice formation, having lateral ridges of ice very steep, and rising some 40 feet above the level of the rest of the glacier. In one place, taking a point on the ice ridge of the Baker, he says: "About 70 feet below it is a new lateral moraine in course of formation; this is gradually merged in the ice ridge. Below this is a hollow, and then at the bottom of the spur, and following it round, comes another small grass-covered moraine, showing that at one time the surface level of the glacier was about 200 feet lower than it is now; while three old moraines parallel to the glacier on the spur to the north point to the fact that it has also been much higher. These signs of constant change are visible near many of the other glaciers, but the Baker is the best example."

Not having much knowledge of botany, I shall not attempt to describe accurately the flora of the New Zealand Alps. It is not so varied as the Swiss, but it makes up in quality what it lacks in variety. There are four or five kinds of ranunculus, including the beautiful *Ranunculus lyalli*, which is to be met with in great quantities, growing practically everywhere in the neighbourhood of the glaciers; celmisias are also very common, in both small and large varieties. Numerous other flowers, of more interest than beauty, are to be found on the moraines and hillsides; while a form of edelweiss, varying but slightly from the Swiss, is to be seen above 3000 feet, and I have found it

as high as 6000 feet on the Malte Brun in great profusion. The "scrub," growing to the height of 6 or 8 feet, is very dense, and is composed of various shrubs, which are no doubt as interesting to the botanist as they are troublesome to the explorer—at least, I hope so. It grows, generally speaking, up to an altitude of 4000 feet, gradually becoming more stunted until it disappears. Above this we find flowers and smaller plants, and I think I am right in saying that in the New Zealand Alps no vegetation has been found higher than 6500 feet. Personally, I have not seen it grow higher than 6200 feet.

Birds are not very common on the glaciers—that is to say, in variety; for we see great numbers of the kea, or mountain parrot, which sometimes kills sheep in the lower country, but is a tame, amusing, and very inquisitive visitor in a mountain bivouac. The glacier wren is found, as a rule, far up the ice; he is very small—not unlike a small sparrow, with no tail and long legs, is very tame, and lives chiefly on the spiders which infest the moraines. Kakas and wekas are also common, the latter being a wingless bird, known all over the colony as an incorrigible thief, stealing anything he can move from a camp. I cannot do better than refer those interested in ornithology to Sir W. Buller's 'Birds of New Zealand.'

Black spiders are very frequently seen in great quantities on the moraines. I have seen one on a small island of moraine surrounded by at least half a mile of ice. Insects, such as moths, butterflies, and whetas are very numerous in some parts, where one would not expect to see them, notably on the comparatively small "corner" of moraine at the foot of De la Bêche, which is surrounded by ice and snow. The last-named, the wheta, is a kind of grasshopper in appearance, and is common to the whole of New Zealand; but Mannering, on the Mount Haast spur, and myself, on De la Bêche, have found small black whetas high up on the snow-fields. These are rare at present, only a few specimens having been obtained about the size of an English grasshopper, and quite black, whereas the ordinary wheta is of many colours and has been found, measuring, I believe, 2 or 3 inches in length, in other parts of the colony.

To conclude, I can recommend the New Zealand Alps to all who are fond of natural research; they offer, in many respects, a new and interesting field.

Map.—The Map of the Southern Alps of New Zealand has been compiled from the Government Surveys. Corrections were made of the Hooker Tasman and Murchison Glaciers by A. P. Harper.

LIEUTENANT RYDER'S EAST GREENLAND EXPEDITION, 1891-92.*

THE last number of the *Geografisk Tidskrift* of the Danish Geographical Society contains a full account of the East Greenland Expedition of 1891–92 (see *Proceedings*, p. 711), in the form of letters from Lieutenant Ryder. The first of these was written on board the *Hekla*, in the ice in lat. 72° 26′ N., long. 9° 56′ W., and the others, written in February and June, 1892, are dated from the winter quarters of the expedition in 70° 27′ N., and 26° 11′ W.

The *Hekla* had great difficulty in effecting a landing on the Greenland coast. Leaving Copenhagen on June 7th, 1891, she met the outer edge of the ice thirteen days later in lat. 68° 12′ N. and long. 13° 5′ W., 220 miles east-south-east of Cape Brewster. But there was no possibility of making way through the ice, and the expedition steamed northwards as far as 76° 13′ N. There the somewhat more open character of the floes raised the hopes of the commander, and he entered the ice. But it was 33 days before the *Hekla* overcame the difficulties offered by pack-ice and fog, and entered Scoresby Sound. Only one landing could be made during this month; this was off Cape Broer Ruys, on the south of the little Holland Island, a fringe of solid ice 5 miles wide having been crossed on sledges. Altogether the year was very unfavourable, and even Jan Mayen, which is usually ice free, was surrounded for about 60 miles by the ice-pack. The width of the floating ice-fields in the east of Greenland attained 300 miles at 68° N., 380 miles at 72° N., 360 miles at 74° N., and 300 miles at 76° N. Under such unfavourable circumstances the members of the expedition considered themselves fortunate in reaching the entrance of Scoresby Sound on August 2nd.

When the *Hekla* steamed westwards in Scoresby Sound it soon became apparent that the great fjord divided into several branches which stretched far inland. The *Hekla* entered the south-western branch of the fjord, in the hope that it might be an inlet leading to Scoresby's Knighton Bay. Near the entrance of this branch an excellent spot for a winter station was found on the coast of an island named Denmark Island, and situated to the south of Milne's Land; and when a renewed attempt at erecting the winter station at Cape Stewart proved unsuccessful—the whole coast being thickly wrapped in ice—it was decided to stay there for winter quarters. On August 23rd the *Hekla* was brought to her winter station.

Various boat expeditions, partly in the steam launch and partly in rowing boats, were made until September 25th, the result being that 3060 square miles were laid down, and the great interior ramifications

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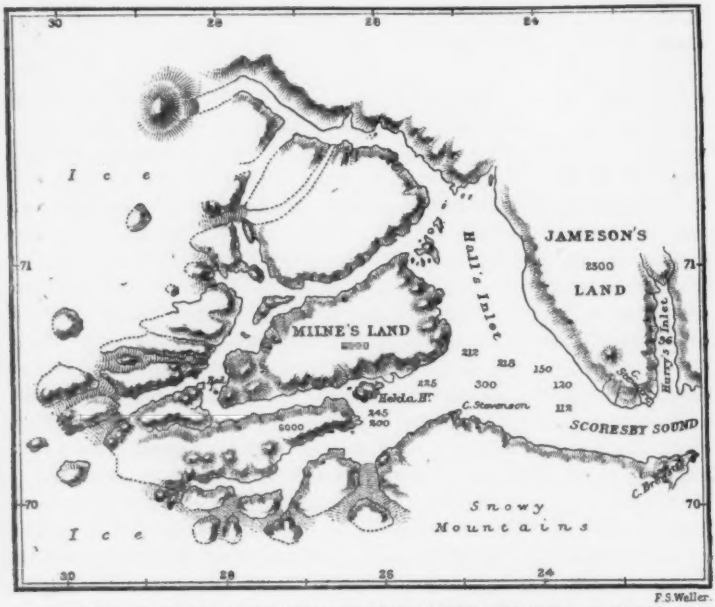
* Revised with additions for *The Geographical Journal* by Lieutenant Ryder.

of Scoresby Sound were explored and mapped. It appeared from these explorations that the Hurry's Inlet, between Jameson's Land and Liverpool Coast, is not an inlet connecting Scoresby Sound with Davy Sound —as supposed by Scoresby—but only a fjord 28 miles long. It has in the east the steep crags of Liverpool Coast, rising to a height of 3000 feet, and seemingly composed of gneiss. Towards the west rise the 2500-feet-high crags of Jameson's Land, which are considered by the explorers as an immense moraine of the glacial age. Many fossils, both animals and plants, belonging to the Jurassic and to Tertiary periods, were collected there.



SKETCH OF THE INNER BRANCHES OF SCORESBY SOUND, BY LIEUT. C. RYDER, ROYAL DANISH MARINE, 1892.

(Scale 50 miles = 1 inch. Soundings in fathoms. Heights in feet.)

At Cape Brewster, where fossils from a period older than the Jurassic have been found, the crags are but from 300 to 500 feet high, and the coast is covered with moraines. It has a relatively rich vegetation, and on standing here one almost forgets that he is in a polar region. On the contrary, the southern shore of Scoresby Sound is a high unindented basalt wall, 60 miles long, covered with small secondary glaciers, which are reconstructed on the slopes out of *débris* of the ice, which falls in cascades from the upper plateau. The interior ice attains a height of about 6000 feet.

The ramifications of the tributary fjords appear in Lieutenant Ryder's map, which we reproduce.

The edge of the inland ice, which is 176 miles distant from the sea at Liverpool Coast, is seen at the heads of the smaller bays of the fjords.

It appears certain that all the fjords reach the inland ice. The heights of the icebergs from the northern glaciers in Hall's Inlet have been measured up to 300 feet above the water surface. Two of the largest icebergs which have been measured have been found to have lengths of respectively 6000 and 3000 feet, and widths attaining 2000 and 3000 feet. The gneiss, which is covered by basalt in the western sounds attains a thickness of 500 feet in the south-west, 3000 feet in Milne's Land, and 6000 feet in the northern part of the explored region. Moraines, glacial striæ, and *roches moutonnées*, testifying to a previously much greater extension of ice, are met with everywhere, even on the tops of the plateaus at a height of 4330 feet.

Animal life is rich, especially in Jameson's Land, where reindeer are seen in wonderful numbers. They also are numerous on the coasts of the interior fjords. Many musk-oxen were seen around Hurry's Inlet, and traces of foxes, hares, bears, ermines, and lemmings were observed in Jameson's Land. The richness of vegetation (150 flowering plants were gathered in Scoresby Sound), and the size attained by it, especially around the western basin, is most astonishing, especially in comparison with what it is on the western coast, or a little further north, where the snowfall is smaller.

No human beings were seen, but numerous winter houses, graves, &c., now abandoned, testify that the fjords were recently inhabited by a relatively numerous Eskimo population. The average temperatures observed were, in Fahrenheit degrees:—October, 19°; November, −4·4°; December, −4·5°; January, −1·5°; February, −11·6°; March, −14°; April, 1·1°; May, 22·8°; the lowest observed minimum being −52°·2. Severe föhn storms, one of which suddenly raised the temperature to 52° Fahr., were experienced in May and the first days of June.

As soon as spring came, sledge journeys were begun, and the exploration of the fjords was continued. No sickness occurred amongst the members of the expedition during the entire time.

In 1891 the winter-ice in the interior of Scoresby Sound had broken up so early that only very little was to be seen when the *Hekla* in August first entered the fjord; in 1892 quite the contrary took place. It was impossible for the ship to get out of the harbour before August 8th; and even at this late date it was with much difficulty that the passage out of the fjord was made, the winter-ice lying in large unbroken masses in the whole of the inner part of the fjord west of Cape Hooker. After a short visit to Cape Stewart, the expedition left Scoresby Sound on August 13th, and proceeded southward along the coast. From Cape Brewster to 69° N. the ice offered no difficulty, but

at the latter point firm unbroken land-ice was met with, which could not be passed either by the ship or with boats. The *Hekla* therefore returned northwards, and got out of the ice on August 18th in 68° 25′ N., 19° 25′ W. A short visit was made to Iceland for the purpose of coaling and taking in provisions; and on August 29th the *Hekla* again left for Greenland, the intention being to try to reach the coast at Cape Grinel and follow it southward to Angmagsalik, but constant easterly storms and packed ice made this impossible. On September 10th the coast was reached at Angmagsalik (65° 40′ N.), the wintering place of Captain Holm. While the ship was anchored in a bay here the expedition made boat excursions northward to 66° N. The ice, here lying packed close to the land, prevented further progress, and it was too late in the season to await a spreading of the ice. All the inhabited places in the district were visited. During the eight years that had elapsed since the visit of Captain Holm the population had decreased from 400 to 300 souls. A very large collection of dresses, weapons, and utensils was purchased from the Eskimo.

On the 26th of September the *Hekla* left the harbour, and after a fine voyage arrived at Copenhagen on October 12th.

PHYSIOLOGICAL EFFECTS OF HIGH ALTITUDES.

By CLINTON DENT, F.R.C.S.

Mr. Clinton Dent, F.R.C.S., sends the following communication, which is a summary of an article published in the *Nineteenth Century* for September last, with additions suggested by Mr. W. M. Conway's recent experiences in the Karakoram:—

"Mountaineering as a special branch of travel has developed so much within the last thirty years, that the oft-discussed question as to the possibility of ascending the highest points of the Earth on foot has assumed a new phase. Probably, as far as practical skill is concerned, mountaineers of the present day are fully qualified to make the experiment. The question is whether the feat is a physiological possibility. The intrinsic 'mountaineering' difficulties are not likely to be insuperable. Assuming that Gaurisankar is really the highest point, it is probable that on the north side the snow slopes will be tolerably gentle. Days must occur, though they might be exceptional, when the snow would be in good order, and not powdery or granular. At the same time, the extremes of heat and cold experienced render it likely that extensive ice-slopes will be met with. Time would prevent any great length of ascent by step-cutting, and success would only be possible when snow overlying the ice was yet

adherent, and in good order for walking. It is tolerably clear that the use of climbing-irons may be essential. Although Mr. Conway's guide, Zurbriggen, cut an immense series of steps, they were not fully fashioned, as would be necessary if no climbing-irons were employed. 'A stroke or two' sufficed. Mr. Whymper's observations are of great interest and importance, but the Andes is not the most favourable field for testing the upward limit of mountaineering. A long sea voyage is necessary; the climate is trying, and the weather abominable. Experience seems to show that great heights can be reached in the Himalaya with less distress than in the Andes. Apparently also they can be reached with less difficulty in Sikkim than in Central Asia. Professor Bert and Mr. Whymper have demonstrated irrefutably that mountain sickness is a real affection. Professor Bert sees in the deficiency of oxygen at great heights the explanation of all the symptoms. Mr. Whymper does not share this opinion, and shows conclusively that Bert's suggested remedy, the inhalation of oxygen, is not practically possible on the mountain-side. Mr. Conway's experience at a height of 23,000 feet (?) seems entirely opposed to Professor Bert's theory. Mr. Whymper regards the expansion of the air or gas within the body and the consequent pressure upon the internal organs, as an important factor; but considers that this may be minimised, or even entirely avoided, by gradual ascent. In the writer's opinion, the mechanical effects of such expansion of air or gas are unlikely to prove at all a serious obstacle. A far more important factor is the effect of diminished pressure on the portion of the spinal cord concerned with the nutrition of the lower limbs. This effect is brought about through interference with the local blood-vessels. Greatly increased pressure also produces much the same symptoms. The circulation of the blood is much impeded through the portion of the spinal cord where it is most demanded while the lower limbs are being exerted. The result is, that the action of walking, which should be almost 'automatic,' at great heights demands a powerful effort. Hence follows fatigue. Recovery can take place, but only very gradually. Mr. Conway took sphygmographic tracings of his own and his guide's pulse at the greatest height he reached. These tracings will probably bear out what has often been noticed before, that the blood has great difficulty in reaching the extremities. Presumably the tracings were of the pulse at the wrist. Comparative tracings of the pulse in an artery such as the carotid in the neck would have been of great value, and such may have been taken. For the turbulent action of the heart and consequent distress might then be shown to be due to efforts to overcome the peripheral resistance rather than to any affection of the heart itself. Certain blood-vessels have to enlarge, and this is a slow process. The increased frequency of the heart's action is due to peripheral resistance. It would appear, as regards the effects due to expansion within the body of gases

as well as to the nutrition effects, that complete recovery and entire habituation to low pressure can take place. Mr. Whymper's dictum, that, in the endeavour to ascend to the greatest heights, 'from the effects of respiration none can escape,' is discussed in the article referred to. Inspiration being a muscular act, the question is, how far the special muscles involved may be trained to extreme and protracted exertion. Actual experiment can alone furnish the full answer. Physiological considerations seem to indicate that in exceptional men the required increase of sustained muscular power could be fully met. In men and animals who remain for some time under conditions of greatly reduced pressure the number of coloured blood corpuscles, the essential oxygen-carriers, increases prodigiously. It is thus apparent that the oxidations of the body may be carried on after a time effectively at great heights. Those who would attempt the experiment must be physically qualified. Anæmic persons are unsuitable. Tolerably full-blooded men, of spare habit, with relatively large bones, will probably suit best. The experience of the workmen recently engaged in the construction of a railway tunnel in Peru, at a height of 15,645 feet, shows that in a period to be measured by weeks, occasionally months, acclimatisation becomes so complete that the individuals are capable of doing full work. The climatic conditions are so much more unfavourable in Peru than in the Himalaya, that it is not unfair to assume that work at a height of 20,000 feet in the latter would not demand greater exertion than at a height of 16,000 in the former. Neither on mountaineering nor on physiological grounds does the possibility of ascending Gaurisankar appear hopeless. To some extent a question of men, it is largely a question of money. Selected men will have to work for a year or more with the one definite object before them if they desire to ascend 6000 or 7000 feet higher than has yet been reached on foot. The attempt would be costly, long, laborious, and not free from risk; but it is possible. The cold due to the diminished circulation through the lower limbs appears to be a more serious factor than has hitherto been imagined. Although the heat of the sun was terrible in Mr. Conway's recent ascent of the Pioneer Peak, 'the cold ground seemed to suck the warmth out of our feet' (*Proceedings*, 1892, p. 763), and the party narrowly escaped frost-bite. Wearing metal climbing irons may have conduced to loss of heat; but it is plain that the best covering for the feet and legs for very high ascents requires special and further consideration. The experience of Arctic travellers will be of value; but it must be remembered that Arctic travellers are not subject to the same interference with the circulation due to the diminished pressure. Certain drugs have the power of relaxing the smaller blood-vessels, and it is possible that these might be of use."

PHYSICAL EXPLORATION OF THE BLACK SEA.

By N. ANDRUSOFF.*

THE hydrographical explorations which were made in the Black Sea in 1890 and 1891 on board the warships *Chernomorets*, *Zaporojets*, and *Donets*, and the schooner *Kazbek*, have already been referred to in the *Proceedings*.† We have accordingly selected from the very interesting general summary of these researches by N. Andrusoff those portions which supplement our previous notices.

The Configuration of the Bed of the Black Sea is very simple, and its main features are shown on the accompanying sketch-map. The 100-fathom line follows the coast closely, except in the north-west part of the sea, where it runs from Varna to the south of the Crimea with a slight inflexion towards the north. From this line the bottom sinks with a relatively steep gradient (of nearly 12°) to a depth of 800 fathoms, and then it slowly sinks to the 1200-fathom line which encloses an oval area in the central part of the sea. The maximum depths of 1219 and 1227 fathoms have been reached within this oval.

On the surface, the Salinity of the water is very small, so that it may be described as brackish. Its density varies from 1·01206 to 1·01372, gradually increasing to 1·01678 at the depth of 100 fathoms, and to 1·01721 at 900 fathoms.

The distribution of Temperature is most remarkable. The upper layer, about 25 fathoms thick, varies in warmth with the seasons. Below it, a layer of colder water (about 44° Fahr.) has been found in July, and from this layer downwards the temperature gradually rises till a depth of 100 fathoms is reached. Below this level, the whole mass of water has a constant temperature of 48°. The cold layer changes its position, and sinks lower down in August (35 to 50 fathoms), so that it is supposed to represent nothing but the layer of superficial water, cooled during the winter, which gradually sinks during the spring, summer, and autumn. But its sinking soon finds a limit when it meets the denser and salter water, which an under-current has been proved to bring from the Mediterranean through the Bosphorus. The vertical circulation of water is thus limited to the upper 100 fathoms or so, and the transmission of heat further down is effected exclusively by conduction through the water itself which acts only to a very slight extent. The distribution of temperature in May and August is shown in the two diagrams, Figs. 1 and 2, accompanying the map. Dissolved air must also be transmitted to the lower layers by diffusion only.

The lower layers contain, as is known, a great amount of dissolved sulphuretted hydrogen,‡ and also sulphides of alkaline and earthy metals, while the total amount of dissolved gases is smaller in great depths than it is in the upper layers. This fact seems to imply that the deep-sea water suffers at the same time from a deficiency of dissolved oxygen, which renders it quite uninhabitable for plants and animals.

The coarse Sediments (littoral deposits) are limited to a very narrow zone along the coasts, and it is only in the north-west that sand covers extensive parts of the bottom. As a rule, a sandy bottom is limited to a depth of from 10 to 20 fathoms, and it is only opposite the Bosphorus that gravel and sand are found so deep as 50 fathoms. Mud prevails elsewhere. Down to the 100-fathom line it is of a light

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* Summary of a paper read in German at the Edinburgh Meeting of the British Association, 1892. Map and diagrams, p. 96.

† 1890, p. 171; 1892, p. 122 and 461.

‡ See *Proceedings*, 1892, p. 462.

grey colour, and contains an astonishing number of thin shells of *Modiola*. On the steep slope of the bottom (100 to 800 fathoms) the mud is dark, but at once becomes grey in the air, owing to the oxidation of the hydrated iron sulphide which it contains. At still greater depths it acquires a light-bluish colour owing to the abundance of carbonate of lime. In all samples obtained from great depths only foraminifera and littoral diatoms were seen. On the contrary, micro-organisms of pelagic origin are very numerous. It is most interesting also that the pollen of conifers is always found in the deep-sea mud. The succession of the various classes of deposit is shown on the profile, Fig. 3, accompanying the map.

Organic Life is, as known, limited to the upper layer of 100 fathoms; at greater depths there is no life whatever.* The *Modiola* ooze zone (20–100 fathoms) is distinguished by a poor but characteristic fauna. Thin, evenly-coloured molluscs (*Modiola phascolina*, Phil.; *Scrobicularia alba*, Wood; *Cardium fasciatum*, Mont.; *Cerithium pusillum*, Jeffr.; *Trophon breviatum*, Jeffr.; *Bulla truncata*, Mont.), numerous common Ascidians, Annelids, very small Ophiuroids (*Amphiura florifera* Forb.), small *Synaptæ* and *Cerianthus vestitus* are the chief representatives of it. The pelagic life of the Black Sea differs from that of the littoral part of the same by its greater richness in pelagic diatoms, little Ctenophores (*Cydippe*), Sagittæ, and large Copepods, as well as by a scarcity of littoral larvæ. From depths of about 200 fathoms only dead diatoms and thrown-off joints of Copepods could be obtained.

One of the most interesting finds was the discovery in the ooze, at depths of from 100 to 600 fathoms, of remains of Caspian brackish water mussels, such as *Dreissena*, *Cardium* (*Monodacna*), *Micromelania*, *Neritina*, and *Clessinia*. Some of them proved to be varieties of species still living in the estuaries of the South Russian rivers which enter the Black Sea, while the others belong to species no longer found in the Black Sea but still living in the Caspian. "This fact, as also the regularity of their distribution and the impossibility of admitting that they may have been carried by the currents or the waves to this depth (where in any case they could not live, the density of water being over 1·01617, while in the Caspian it is only 1·01125), compel us to assume that by the end of the Pliocene epoch, and probably also at the beginning of the Quaternary period, the Black Sea was a great brackish lake whose fauna was similar to that of the Caspian. A communication with the Mediterranean did not exist at that time, and, as is shown by the beautiful researches of Neumayr, land occupied the place of the Ægean Sea." The Bosphorus was probably pierced by the end of the Glacial period, and it gave access into the Black Sea to a Mediterranean fauna.

The access of the very salt Mediterranean water and its accumulation in the deeper parts of the sea is what prevented the vertical circulation of water, and indirectly led to an accumulation of sulphuretted hydrogen in the lowest layers. The former inhabitants of the great depths disappeared in consequence of the greater salinity of the intruded water, while the small depth of the Bosphorus prevented the immigration of new deep-sea forms. The great number of organisms which died in consequence of the change led to the formation of sulphuretted hydrogen, and vertical circulation in water having been rendered impossible, the gas remained dissolved in large quantities in the lowest layers. The supply of sulphuretted hydrogen is still maintained by the decayed vegetable organisms carried by the rivers as well as by the decaying organisms of the superficial layer whose remains are not destroyed in the Black Sea by deep-water forms of life, as they are destroyed in the ocean, and are not oxidised in consequence of the greatly-reduced proportion of oxygen, which is

* *Proceedings*, 1892, p. 461.

characteristic of the great depths of this closed basin. The analysis of the gases contained in the samples of water which were taken from different depths will give more reliable data to test the probability of the above suggestions. Meanwhile the curve, Fig. 4, accompanying the map shows approximately the rate of increase of sulphuretted hydrogen with depth.

CHITRAL.

Chitral or Kashkar, to which public attention is at present directed, in consequence of the exciting events that have ensued on the death of Aman-ul-Mulk, the former Mehtar or ruler of the state, is a petty state situated on the southern slopes of the Hindu Kush Mountains, amid spurs whose peaks range from 14,000 to 25,000 feet in height. It lies about 150 miles from Gilgit, our nearest military station, and about 200 miles from Peshawar, at an average altitude of 5200 feet above the sea. To the northwards Chitral territory extends at least to the crest of the Hindu Kush range, and southwards it includes the valleys of the Kunar River and a few tributaries. On the extreme south it is bounded by the petty states of Asmar and Dir, the main valley above these limits being reputed to be of extraordinary fertility.

There is little level ground throughout the district, and the people build their villages on the ridges and slopes of the mountains, and there till the land available for cultivation.

Chitral itself comprises six large villages, extending for 3 miles along both sides of the Kunar or Kashkar River, at a point where the valley widens suddenly and the landscape undergoes a complete change, the mountains becoming thickly clad with pine forest. The climate is similar to that of Kashmir, with heavy and frequent rainfalls. The same feature is observable eastward of Chitral and along the watershed between the Gilgit and Indus rivers, which separates two very dissimilar regions, one comparatively arid and the other with abundant rainfall.

On the right bank is the fort in which the Mehtar or Badshah resides. The population subject to him number between 150,000 and 200,000 souls, an estimate which does not include the Bushgali Kafirs, who are tributary, or the subjects of the Yassin ruler. Chitral has been at different times tributary to Badakhshan, Afghanistan, and Kashmir, and the late Mehtar, according to Major Biddulph, paid in 1889 a tribute of horses, hawks and hounds to the Maharajah of the last-named State. For some few years past a native agent of the British Government has resided at Chitral.

Major Biddulph says that the population of Chitral is a curious and intricate ethnological puzzle. The largest section of the population are the Kho, who inhabit the whole of Kashkar Bala, the Ludkho, and Arkari Valleys, and the main valley down to Darosh (Drúsh of

Raverty), and have penetrated eastwards as far as Chashi. They call the country also Kho, dividing it into different sections, under the names *Turi*kho (upper), *Mul*kho (middle), and *Lud*kho (great), while the language is styled Kho-war. This is the language given by Dr. Leitner under the name Arnyia, by which it is known to the Shins of Gilgit. In sound it is soft and musical, and a vocabulary and grammar are appended by Major Biddulph to his book.*

Biddulph estimates that Chitral can collect about 6000 fighting men, if not more, and Raverty remarks that they are said to be excellent marksmen, and powder and lead being exceedingly scarce to be very careful in aiming.

The principal routes in the country are (1) from Jelalabad or Peshawar to Yarkand, and (2) from Chitral *viâ* Mastuj and Yassin to Gilgit. By the Tui pass Mastuj can be reached in five days, but the pass is 16,000 feet, and difficult, and can be used only in summer. Another, and longer, though easier route, crosses the Shandur plateau, which is about 12,000 feet above sea-level, and forms the watershed between the Gilgit and Laspur rivers. It is open to traffic of all kinds throughout the year. To the north, there are numerous passes which lead from Chitral territory over the Hindu Kush range into the Valley of the Oxus, and it is the existence of these that invests Chitral with considerable strategic importance.

The best known pass is that usually called by English writers Barogil (12,000 feet above sea-level), though it appears that that name is more correctly applied to the plain. Raverty calls it the Palpi Sang Pass, and Pilpi Sung is marked in the Surveyor-General's "map of the Punjab and neighbouring countries" (Calcutta, 1854), though too far west. Muhammad Amin says it is practicable for laden carts, though for three months it is closed by snow. Then follow, proceeding westwards, the Ochili, Rich, Ishtragh, Khatira'h or Kharteza, Nuksan, Agram, Dora or Do Rahah and Apaluk Passes. East of the last is the lofty peak called Tiraj Mir or Tirich Mir, 25,426 feet in height (according to Col. Tanner), a magnificent mountain which fills the whole landscape as one looks northward from Chitral, and is also visible from the Oxus Valley. Both the Nuksan and Do Rahah Passes were crossed by the Havildar, the one in September and the other in November, and their difficulties certainly appear to justify the meanings of the two words as given by Raverty.

The Apaluk Pass is scarcely known by geographers, though it appears as "Ebauluk" on the Calcutta map mentioned above, and Colonel Tanner says he heard of the name in the course of his explorations. Raverty says it is a very important pass, strategically considered, and leads from Badakhshan *viâ* Lut-Dih, and Harandu to Jelalabad.

* 'The Tribes of the Hindoo Koosh.' Calcutta, 1880.

The Shui and Thuret passes lead into Kafiristan across the lofty spurs which flank Chitral on the west.

The chief authorities on Chitral are Moorcroft, the Pandit Manphul, Muhammad Amin, Faiz Buksh, Major Raverty (J. A. S. B, for 1862 and 1864, and 'Notes on Afghanistan,' pp. 152–163), the "Havildar" (Journal R. G. S., Vol. XLII., 1872), the "Mullah" (Report on the Trans-Himalayan explorations, 1873–1875), and Biddulph in his 'Tribes of the Hindoo-Koosh.' Besides the last-named author (who, it may be mentioned, collected a valuable series of forty-six routes about Gilgit and the surrounding hill-country), the late Mr. McNair, Mr. Ney Elias, Sir William Lockhart, Colonel Durand, Dr. Robertson, and Mr. Kitchen have all visited Chitral in recent years. The best map of Chitral is the "Map of the Upper Oxus Valley," in two sheets, by Mr. J. B. N. Hennessey, on the scale of 12 miles to the inch. It embodies Mr. McNair's work.

TREATY-MAKING IN AFRICA.*

By Captain F. D. LUGARD.

GEOGRAPHY has lately, I understand, been defined as the description of all that relates to the Earth's surface, and so it includes to some extent ethnology and the customs and habits of tribes and nations.

We hold a written bond "in black and white" to be a sacred thing, binding in a peculiar way on those who deliberately sign it. But this is a civilised idea, foreign to and in no way understood by the savage. There exists in Africa, however, a parallel institution, and when I learnt its significance it seemed to me that I had found the nearest equivalent possible to our idea of a contract. This is the ceremony of blood brotherhood, and it is held in Africa among the most savage and uncivilised tribes as the most solemn and binding of contracts. The rite is performed in various ways, always with the utmost solemnity and *empressement*.

Treaty-making occupies a large place in most modern works of African travel, and since there are different methods of treaty-making,—I have known a valuable concession purchased by the present of an old pair of boots,—I am anxious to explain to geographers the proper procedure followed by responsible and duly-accredited diplomats in that Continent. I must pass over the description of the various modes in which blood brotherhood is concluded, and speak only of the general idea which pervades the contract. Seated cross-legged on a mat opposite to each other on the ground, you should picture a savage chief

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* Introduced by Captain Lugard at the second reading of his paper, on his travels in the Uganda region (see *Proceedings* for 1892, p. 817), November 24, 1892.

in his best turn-out, which consists probably of his weapons of war, different chalk colourings on his face, a piece of the skin of a leopard, wild cat, sheep or ox—*et preterea nihil*; and facing him myself in a costume which at times would make the fortune of a crossing-sweeper. The chief's brothers or principal men stand forth, and taking his spears, his shields and his sword hold them above his head and swear upon them in his name friendship eternal with the white man. "My hut is yours by day or by night; my country shall welcome you as a son of the soil. If you are in trouble I and my warriors are at your command to fight for you to the death; my wives are yours; the food of my land is yours." So runs the invocation with many laudatory terms of his own and his blood brother's prowess as warriors, our power and our invincibility when combined against all comers.

To a savage, the most precious thing in this world or the next are his spear and his arms of war; more precious than his own skin. They are his heirlooms, his sole possession—more thought of, more cared for than his wives—they are never out of his hands by day, they lie beside him at night. His oath is sworn on these, the gods of his existence. I fancy the inference is that if he turns traitor his own arms shall turn against him.

Then my pet rifle is held aloft over my head and my interpreter stands forward and repeats my pledge. That I will be a friend to these people; that my men shall not molest them; that if crops are stolen, or wrong done I will make it good; that if enemies attack him near to my camp I will help him; that he shall look on the British Company "as his big brother" whom he has to obey, but who have not come to eat up his land, or oust him from his place; and so on, according to the special stipulations I may wish to make with the individual chief. Then he produces his primest sheep, or goat, or ox. Part is eaten by him, part by me; the blood from my arm or chest has ceased to flow, and we rise as "blood brothers." Then I put down on paper what was the pith of the contract between us; *that* is a treaty as I consider it.

This is the ceremony in a savage land; but in Uganda the procedure is quite different. There the king and chiefs already have an infant civilisation. They most thoroughly understand the nature of a written contract, and consider nothing definitely binding till it is written down. Most of them write. Every clause is discussed in all its bearings, sometimes for days; words are altered, and the foresight and discrimination which the natives show in forecasting the bearing in the future of every stipulation is as keen almost as would be that of Europeans; then the document is translated into their language, Kiganda, and read in silence and with intense attention before the assembled chiefs in State Barza at the king's large assembly house; then the king makes his mark and every individual chief signs his

name. The treaties thus made by the representative of a company acting under Royal Charter are submitted at once for approval to Her Majesty's Government through the Foreign Office. It is obvious that it is only by an abuse of language that such action can be described as filibustering.

THE FAYUM AND LAKE MOERIS.*

The degree of credence which it is considered safe to bestow on the descriptions of the early Greek geographers varies from time to time and from person to person in a somewhat curious manner. The existence of Lake Moeris, as described by Herodotus and subsequent writers, has been doubted, denied, and reasserted; the fact that it no longer exists is apparent, and theories to account for its disappearance if it did exist are numerous and most of them unsatisfactory. At present the balance of opinion, strengthened by recent readings of hieroglyphic inscriptions, inclines towards belief in the past existence of the lake, and the question of its exact situation has incidentally acquired more than historical interest. Mr. Cope Whitehouse has argued that if a lake capable of regulating the Nile floods and reinforcing the water-supply for irrigation at low Nile existed once, it must be possible to restore it and so vastly enhance the commercial value of the cotton-lands of Lower Egypt. There is practically no difference of opinion as to the neighbourhood near which this lake was situated. It must have been in the modern province of Fayum, an oasis lying much below Nile-level on the left bank of the river above Memphis, and irrigated from the Nile by a canal known as the Bahr Yusuf.

The drawback which beset the earlier theorisers was their ignorance of the exact configuration of the district in question, and the only claim which Major Brown makes to originality is, that he has been able to argue out his views on the basis of an exact survey of the Fayum province. His position as Inspector-General of Irrigation for Upper Egypt has made him minutely familiar with the levels of the country, with the effect of evaporation, the regulation of irrigation, and all those practical details which enable one to form correct opinions on a question which largely involves engineering.

His book consists of five short chapters dealing respectively with The Fayum of To-day, Ancient Testimony about Lake Moeris, Theories as to where and what Lake Moeris was, History of the Fayum

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* 'The Fayum and Lake Moeris,' by Major R. H. Brown, R.E. London, Edward Stanford: 1892.

Province, and lastly, The Fayum in the future and possible utilisation of the Wadi Raian. Of these the first and fourth are most important, and to their contents it is advisable to direct attention.

The Fayum is an oasis surrounded by desert, and separated from the Nile by a tract of barren sand from 2½ to 7 miles wide, broken by a narrow fertile strip along the Bahr Yusuf. The contour-line of 100 feet above sea-level practically bounds the province, and except at the entrance of the Bahr Yusuf there is no gap below this level in the encircling hills. The map illustrating Mr. Cope Whitehouse's article in the *Proceedings* for 1890, p. 685, shows the approximate contour-lines of the depression, which in three places sinks below sea-level, viz., in the shallow Gharak Basin in the south, the larger Wadi Raian in the south-west, where the lowest point is 131 feet below sea-level, and surrounding the Birket-el-Kurun in the north-west, where the water-level of the lake stands at 141 feet below sea-level, and its deepest part is probably as much as 200. The Wadi Raian is separated from the Fayum proper by a gap at the level of 85 feet above the sea, and its hollow shows no trace of geologically recent water-action nor of Nile deposits. The whole of the Fayum depression dips towards Lake Kurun, to which all the surplus irrigation water finds its way; but evaporation is so far in excess of the supply, that since 1885 the level of the water has been falling at the average rate of 20 inches per annum. In the Fayum depression there are abundant deposits of Nile mud up to the contour-line of 85 feet, and the contours show a fan-shaped elevation projecting from the entrance of the Bahr Yusuf exactly similar in form to a delta thrown down by a mud-laden river entering a lake. The depression is now thoroughly irrigated and grows enormous quantities of cotton, cereals, and fruit, there being as a rule two crops in the year, and sometimes as many as three in fifteen months. A railway connects this fertile district with Cairo.

From his study of the figures, which are fully worked out in the book, Major Brown has come, with apparently good reason, to the conclusion that the whole Fayum province, excluding the Wadi Raian, was once a lake fed from the Nile—the original Lake Moeris; that this lake was not of artificial formation, but was brought under control by the Pharaohs, and the land gradually reclaimed; and that it might have been employed as a reservoir to supplement the low Nile. He enters very minutely into the statistics of Mr. Cope Whitehouse's plan for utilising the Wadi Raian as a storage reservoir. This could be done if no attempt were made to use it for modifying Nile floods. As a reservoir for supplementing low Niles in Lower Egypt the Wadi Raian could probably be used also to receive the irrigation, drainage, and surplus flood-waters of the Upper Nile valley.

Major Brown's work is so concise, as well as so thorough, that it is practically impossible to convey a correct impression of it in an abstract.

He brings forward no statement without a full array of reasons, and he contradicts no hypothesis without showing what he believes to be ample proof. The book is a model of scientific precision, and the illustrations from the author's photographs convey an admirable impression of the scenery of the district described.

A GREAT COLUMBAN ATLAS.*

THE reproduction of ancient maps has always had a peculiar interest to geographers, and such works as those of Santarem, Jomard, Nordenskiöld, and Lelewel have been of inestimable value to students of geography and history. Most of the maps in Santarem's and Jomard's atlases being coloured reproductions, necessarily convey a more correct idea of the originals than those in which this important feature has been omitted, and it is doubtless with the knowledge of this fact before them that the Berlin Geographical Society has been at such pains to give an exact reproduction of the maps contained in this atlas, which it has published in celebration of the fourth centenary of the discovery of America.

The production of this work, which is dedicated to the German Emperor, was undertaken by Dr. Konrad Kretschmer, under the direction of Baron von Richthofen, President of the Berlin Society, and the manner in which they have carried out the work reflects the greatest credit on themselves, and the Society to which they belong.

The atlas, which is accompanied by a volume of letterpress, contains the history of exploration and cartography from the time of Strabo to the sixteenth century. Twenty-four of the plates are reproductions, now published for the first time. They have been copied from parchment documents in all the principal European libraries, and are exact reproductions of the originals. Of the remaining sixteen maps, some have been reconstructed, or reduced in scale to meet the requirements of the atlas. Among the more striking maps are the following: Map by Bartolomeo Pareto, 1455, in the Victor Emanuel Library at Rome; map of the world by Giovani Battista Calviro e Oliva, 1673, in the National Library of Naples; maps from the atlas of Angelus Eufredutius, 1556, in the Communal Library of Mantua; several maps by Battista Agnese, of the latter half of the sixteenth century, in the University Library of Bologna; map from the atlas of Aloysius Cesanis 1574, in the Library of Parma; copy of a globe by Francisus Bassus Mediolanensis, 1570, in the University Library of Turin. The circular maps, such as the Hereford map, have all been redrawn, coloured

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* 'Atlas der Festschrift der Gesellschaft für Erdkunde zu Berlin zur Vierhundertjährigen Feier der Entdeckung Amerikas.' (With text).

alike, and reduced to an uniform scale, in order to facilitate comparison. It has been considered advisable to introduce some colouring on maps of the sixteenth century, to make the outline more distinct; but where this has been done, care has been taken to keep them uniform with the other coloured maps of the same period. Some of these have been published before by Jomard, Lelewel, and Santarem in black. All the maps have been photographed from Dr. Kretschmer's drawings, and printed in colour, except plates 22 and 31, which were engraved. It would be impossible to speak too highly of the manner in which these beautiful maps have been produced, and the more closely they are examined the more the excellence of the colour registering is observable; while the fact that they have been constructed under the supervision of Baron von Richthofen is sufficient guarantee that the maps accurately represent the originals.

The volume of letterpress is in itself a most valuable work on the gradual development of geographical knowledge from the earliest times to the sixteenth century. It contains six chapters, which in turn deal with the different epochs of geographical discovery. It may seem invidious to make any distinction where all is excellent; but as the occasion which has called forth this atlas is the celebration of the fourth centenary of the discovery of America, it seems probable that Chapter IV., which deals so ably with the state of geographical knowledge at the time of Columbus, will be read with greater interest than other portions of the book. To geographers, however, there is no portion of the letterpress which does not contain matter of interest; and, taken as a whole, it is a monument of painstaking research. In the interest of those who do not possess the advantage of being able to read German readily, it is to be hoped that an English edition of the letterpress may soon be published; meanwhile, the Berlin Geographical Society, its President, and Dr. Konrad Kretschmer, have laid the geographers of the world under considerable obligation to them by the production of this admirable work.

THE GEOGRAPHICAL JOURNAL.

At the commencement of this new series of the Society's monthly publication, it may not be uninteresting to recall its growth in the past. Mr. Markham, in his 'Fifty Years' Work of the Royal Geographical Society,' published in 1881, has summarised the early changes which led to the form then established. From the foundation of the Society in 1830, a *Journal* was issued containing the papers read at the meetings, illustrative maps, and analyses of other papers on kindred subjects. Lists of recent geographical publications and maps were subsequently added, and the annual volume was issued in two, or occasionally, in three parts. In 1847, the *Journal* took a

backward step, the analyses of papers not read to the Society, and the miscellaneous information were discontinued; and from 1848 to 1855, the *Journal* was only issued once a year. The thin volumes of those years remain as an outward sign of the crisis which the Society successfully passed through in that period of reduced resources. With regained prosperity and increasing membership, the demand for a more comprehensive and speedy method of publication naturally arose. The number of members increased rapidly from 700 in 1850 to over 1000 in 1858; it exceeded 2000 in 1868, and reached 3000 in 1876. Since that time the rate of growth though slow, has been steady. Mr. Francis Galton, then Secretary, proposed to issue *Proceedings* supplementary to the *Journal* in 1855. The *Proceedings*, as then arranged, contained reports of the evening meetings, and a variable amount of general geographical information. The parts were issued irregularly, about six being published in the course of a year. The *Journal* continued to appear annually, and in it the larger and more important papers and maps communicated to the Society were given to the world. The next change of importance was the successful attempt in 1879 to retrieve a lost opportunity.

In 1872 Mr. Clements R. Markham, at that time one of the Secretaries, realising the public demand for a geographical journal on a wider basis and of more popular form than then existed, and finding that the Council were reluctant to modify the Society's publications, became editor of *Ocean Highways—The Geographical Record*, which subsequently had the sub-title of *The Geographical Review*, and finally took as its name, *The Geographical Magazine*. This Magazine was quite unconnected with the Society. It aimed to advance geographical knowledge by means of original articles, reviews of books and of maps, concise items of geographical news, obituaries and personal notices, together with reports of meetings of Geographical Societies and original maps. The magazine was published monthly, and acquired a good circulation. Its last number appeared in December 1878, the date at which the twenty-second and last volume of the old series of *Proceedings* was completed. Mr. Markham, in referring to the old *Proceedings*, observed, "This publication was capable of great improvement and of being made the leading authority in the world on all subjects relating to geography." It is largely to his success in showing the way by means of the *Geographical Magazine* that the new series of *Proceedings* was started on such admirable lines. "The *Geographical Magazine*," he said, "completed its work and fulfilled its mission. Its labours were not in vain, its objects did not die with it, but were actively and ably pursued by its successor." The new series of *Proceedings* incorporated many of the new features which the *Geographical Magazine*, now stopped by arrangement, had experimented with and proved to be of value. The parts appeared monthly and contained the papers read to the Society,

with the discussion which followed, occasional illustrations and maps. Other papers were also published, together with geographical notes, reports of the Society's meetings and of the proceedings of foreign societies, obituary notices of deceased fellows, correspondence, and brief non-critical notices of new books and maps. The fiftieth and last volume of the *Journal* appeared in 1881, although the volumes of *Supplementary Papers* which are still published at irregular intervals may be taken as representing it.

'The Proceedings of the Royal Geographical Society, and Monthly Record of Geography,' retained its original form for fourteen years, but minor modifications were introduced from time to time, by order of the Council, or at the suggestion of the Editor. More space came to be devoted to notes and book notices, and in the last few years illustrations and block-maps, in the text, were much more frequently introduced. The steady growth of the Society, and the stimulus given to scientific geography by the action of the Universities, at the instigation of the Society, have once more led to a demand for fresh expansion. It is felt that if the Society's publication is to maintain its position as the leading geographical journal in the English language, it must be made more systematic and more exhaustive. While if it is to take the place which a serial on the lines of the old *Geographical Magazine* might now hold, more attention must be paid to literary form, and to the methods of illustration. The fundamental object of the *Geographical Journal* is to carry out in its fullest meaning the first article of the Society's constitution. "The Royal Geographical Society is instituted for the improvement and diffusion of Geographical Knowledge." In pursuit of such an ideal it is not enough to keep from losing ground. The whole current of periodical literature has swept forward into a new region during the last twenty years, and the *Geographical Journal* is the natural outcome of the progressive growth of the *Proceedings*.

The *Geographical Journal* will in substance differ little from recent volumes of the *Proceedings*. "The Monthly Record" will be the old "Notes" arranged systematically, and selected so as to give a general view of the geographical work and thought of the world during the preceding month. The "Geographical Literature of the Month" will revert to the early system of giving a brief non-critical notice of all books added to the library. It will also include a systematic list of all important articles in other geographical journals, British, Colonial, and Foreign, and of geographical papers in any periodical publications which come under the notice of the Society. In this way there will be a monthly subject-index to current geographical literature that cannot fail to be useful to all working geographers. The value of this list will be more apparent when the exhaustive subject-catalogue of the Society's Library now in hand is completed, as that catalogue will thus be kept continuously up to date. The section

devoted to New Maps will be arranged on essentially the same lines. Both books and maps of importance will be occasionally reviewed at length in separate articles.

It is hoped that in its new form the Society's *Journal* will be found interesting by a larger circle than that of the Fellows alone, and that the impartial and authoritative descriptions of the regions on which public interest is for a time concentrated will be helpful to all who really wish to grasp and comprehend the geographical conditions on which modern politics and commerce are based.

THE MONTHLY RECORD.

THE SOCIETY.

Programme for 1893.—The Second and longer portion of the Session promises to be of considerable interest. The first paper in January will be by Mr. Charles Hose, one of the residents under the Rajah of Sarawak, Borneo, who has travelled extensively in the interior. On January 30 two interesting papers on 'The Island of Yesso' are expected—one by Professor John Milne, F.R.S., of the Engineering College, Tokio; the other by Mr. A. H. Savage Landor, who has been all round the island and up some of its principal rivers. Mr. F. C. Selous has just returned from Mashonaland, and as at present arranged he will give the leading results of his twenty years' wanderings in South Africa on February 13th. It is hoped that Captain Bower will be able to give an account of his remarkable journey across Tibet at the other meeting in February. The two March meetings may be occupied by Professor Bonney, F.R.S., on 'The Work of Glaciers on the Earth's Surface,' and Mr. H. O. Forbes, on his investigation of the Chatham Islands. The papers for the other dates are not at present fixed. Mr. W. M. Conway hopes to be ready by the April meeting to describe the results of his expedition to the Karakoram Mountains. Other papers promised are by Captain Pringle, on the Railway Survey from Mombasa to the Victoria Nyanza; Mr. W. W. Rockhill, on his remarkable Journeys in Eastern Tibet; Lieutenant Peary, on his Expedition to the North of Greenland, and his proposed Expedition towards the North Pole. Mr. H. J. Mackinder begins his course of educational lectures on Friday, January 20; Fellows of the Society who mean to attend are requested to inform the Secretary by January 13.

EUROPE.

The Baltic Lake-plateau.—Dr. W. Ule has lately contributed to *Ausland*, an investigation of the agencies which produced the lake-dotted band of high ground traversing the North-German plain south of

the Baltic. The flanks of this ridge form both to north and south a gently undulating tract, often unfit for cultivation, and covered only with firs and heath. In the centre is a confused jumble of hills and deeply-cut valleys, where fields, green pastures, and woods of deciduous trees meet the eye. A general view of the region on a map shows that hills and valleys follow a prevailing north-east and south-west, or north-west and south-east direction. Lakes, some with very irregular outline, others occupying wide basins, or narrow river-like channels, abound in all parts, but are, as a rule, of simpler outline in the outer than in the central tract. An important fact brought out by soundings and other observations, is that the form and geological structure of the basins is the same above and below the water-line; therefore they must date from the original deposit of the surface formation, and depend for their origin on the causes which have produced the general features of the country. The most important of these seems undoubtedly the massive ice-sheet, which, according to geologists, once spread over the whole North-German plain. Beneath 330 feet thickness of glacial deposits Jurassic strata appear, showing that even before the ice age a rising ground existed, which probably formed a dam to the progress of the ice southwards. The ridges and hollows seem, however, to be due to the ice which, overcoming the resistance of the loose surface materials would keep in the main one direction, and as it periodically diminished and extended, would form parallel deposits of boulder-clay both at its end and sides. Boulder-clay constitutes the chief surface material in the central region, while sand, etc., spread over the country by the water rushing from the glacier-wall forms the outer tract. Running water must have been an important agent. The streams beneath the ice-sheet would have some effect, but more so those resulting from the melting of the ice during its slow retreat, and those of post-glacial times, though the importance of these last would be limited somewhat by the large number of basins which have no outlet. Underground waters too, probably play their part. It seems that many of the enclosed basins are drained in this way, in consequence of which the soluble components of the soil would be carried away, and sinking of the ground perhaps result. In this way the existence of the many pools on otherwise level ground, as to which we have yet no other explanation, would be accounted for. Lastly, the action of the wind in removing and depositing materials deserves notice. At present we cannot determine the precise share of work done by each of these agencies, and mistakes have been made by insisting on one or another to the exclusion of the rest.

Highest Summit in the Crimea.—Recent surveys in the Crimea have rectified the altitudes of some of the summits. Hitherto Russians have looked upon Chatir Dagh as the greatest height of European Russia, but,

it now appears that Roman Kosh is higher, having an altitude of 5061 feet, being 59 feet greater than Chatir Dagh.

Exploration in the Eastern Caucasus.—Herr Merzbacher sends an account of his travels in the Eastern Caucasus during last summer. The traveller was forced to give up his original plan of continuing the exploration of the Bezingi Group in the Central Caucasus by the cholera, which raged throughout the Nalchik district, and the consequent local quarantines and other obstacles. He therefore turned his attention to the lofty and comparatively isolated Tebulos and Bogos Groups, which separate Daghestan from the country of the Chevsurs and Tushets on the south, and the Bogos Range in the heart of Daghestan, known to us through Dr. Radde's travels, but hitherto unexplored above the snow-level. On July 17th Herr Merzbacher left Tiflis with two Tyrolese guides and crossed the Adzumba Pass to Tushety. In this region the rainy season generally lasts from the middle of July to the end of September, and the travellers were warned on all sides to expect bad weather. They were, however, favoured with the finest weather, as well as by the valuable assistance of the government officials, and Herr Merzbacher's own experience in the previous year in the Central Caucasus. "Consequently," he writes, "I was able fully to carry out my plans, to explore thoroughly the mountain groups, and to obtain many observations and photographs from high stations, which will be of great service in determining the orographical details. The characteristics of the Tebulos Group are the jaggedness of the ridges and sharpness of the ice-crests. In the Donos Group the variety and grandeur of the mountain forms exceed even those of the Tyrolese Dolomites. In the Bogos or Botshok Group, on the other hand, the extent and magnificence of the glaciers is the chief feature. In this respect they can compare with many parts of the Central Caucasus, as the inferior height of the peaks is compensated for by the low elevations to which the glaciers descend in the valleys. Nowhere have I seen more beautiful valleys, and I think my photographs will prove this. The mountains of Daghestan conceal in their recesses scenery, the magnificence of which is still wholly unknown to the world, and beyond my powers of description. The character of the landscape differs entirely from that of the Central Caucasus or the Alps, and the people and their dwellings and customs are so interesting that I came back delighted with my journey. The following is a list of the summits I ascended. The heights are given provisionally in round numbers until my observations upon which I am now occupied are fully worked out. Tebulos Group: Spur of Tebulos, 13,290 feet; Tebulos Mta, 14,930 feet; Tuga Mta, 13,940 feet. Donos Group: Kumito Tau, 14,140 feet; Donos Mta, 13,940 feet; Rock Peak of Kocheksferi, 12,140 feet; Diklos Mta, 14,040 feet. Bogos Group:

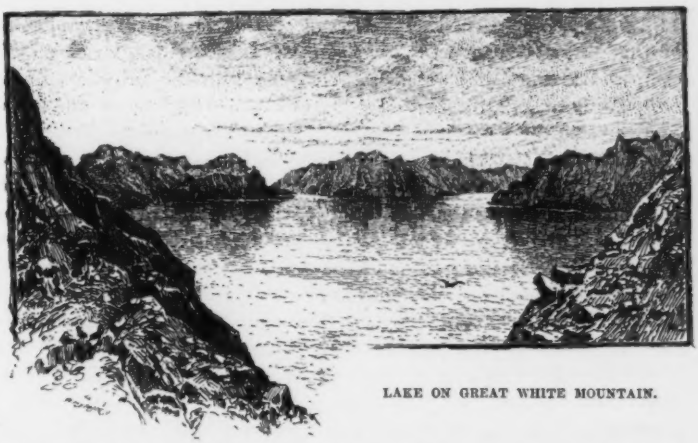
Anchovalla, 13,450; Bogos Mir, 13,610; Belenki Mir, 13,520; Addala-shukchol, 13,780. On October 23rd I ascended Ararat from the south-east. At this season it was impossible to camp higher than 9000 feet, and the ascent of the remaining 8000 feet took nearly twelve hours, and was very fatiguing. We were very disagreeably affected by the rarity of the air."

ASIA.

The Old Bed of the Oxus.—Among the latest contributions to this much-vexed question, those of R. v. Erckert and W. Komischke in recent numbers of *Ausland* are of some interest. The statements of early writers from Herodotus to the Arab historians, that an arm of the Oxus emptied itself into the Caspian (at least intermittently) are well known, and this arm has been identified with the Usboi channel, which traverses the Kara Kum desert in the latitude of the lower half of the Caspian. The historical side of the question is fully dealt with in the papers referred to, and we can only notice here, firstly, the universal confusion of the Aral with the Caspian down to the 10th century of our era, the latter being supposed to stretch east and west, instead of north and south, and secondly, that the sea, spoken of by the Arabian writers does not at all agree with the Caspian in extent an distance from Khiva, and that there is no trace of the extensive population and cultivation spoken of by them along the said arm, anywhere in the vicinity of the Usboi channel. Both writers come to practically the same conclusion from an examination of the question in the light of recent geological and other surveys, principally those of Mushkétof and A. Konshin. (This question has been fully dealt with by Mr. Delmar Morgan in the *Proceedings* for 1892, p. 236.) Komischke traces the gradual drying up of the old sea which, according to Mushkétof, filled the basin of Turkestan, and whose old shore-line may still be seen in parts of the desert, *e.g.*, near Charjui. The Usboi formed the last connecting channel between the Caspian and Aral basins, after the elevation of the Ust Urt plateau and Balkan ranges had separated them elsewhere. It is evident that the Arabian writers may have been justified in their statements as to the arm of the Oxus flowing to the Caspian (Masudi speaks of it as derived from Lake Aral, into which the Oxus had first entered) by temporary overflowings of the Sari-Kamish basin owing to unusual floods in the Oxus.

The Lake on the Great White Mountain.—The photograph from which the accompanying illustration is taken has been sent to the Society by Captain A. Cavendish, who writes:—"The photograph sent is combined from three taken with a small 'Kodak' by Captain Goold-Adams, R.A., in October, 1891. He and I travelled in Korea, and owing to the impossibility of getting enough men to carry provisions, &c.,

for two, he alone made the ascent of the White Mountain. He left Po-chin (see Mr. C. W. Campbell's map in the *Proceedings* for March, 1892), and reached the mountain by the right bank of the Yalu, making the ascent from the same hut as Mr. James, Mr. Fulford, and Captain Younghusband did. He with great difficulty induced a young Korean to ascend the mountain with him; the other seven Koreans in the party were afraid to do so. The photograph was taken looking about north-north-east across the lake, and the source of the Erhtao-chiang, the eastern branch of the Sungari, flows through the cleft on the north



LAKE ON GREAT WHITE MOUNTAIN.

side of the lake. Captain Goold-Adams with an aneroid calculated the height of the mountain to be 8700 feet above the sea. I hope some day to get some more photographs of this unexplored region, as I intend, if possible, to revisit it."

The Ruins of Karakoram.—The position of the ruined city of Karakoram, in Mongolia, has been the subject of much discussion, and alternative sites are shown in the last edition of Stieler's atlas, according to the rival theories of D'Anville and Remusat. Paderin's visit to the region in 1873 resulted in the discovery of a third probable site (not shown in Stieler) considerably to the north of either of the others (see *Geographical Magazine*, I. (1874), p. 137), and almost due west of Urga. The modern name of this place is Kara Balgassum, and its position, as determined by Yadrintzeff in 1890 (see *Proceedings*, 1891, p. 385), is 47° 15′ N. and 102° 20′ 15″ E., a position somewhat south-west of Paderin's. Several English travellers have planned to visit Karakoram, but none are actually *en route*. Meanwhile we are informed by the *Deutsche Rundschau*, that Dr. J. Troll has set out for an exploring journey in Central Asia, having reached Samarkand in the end of

October last with the view of travelling through Russian and Chinese Turkestan, studying the Karakoram ruins, and returning through Pekin and Shanghai.

Himalayan Exploration.—The *Oesterreichische Alpenzeitung* for December 9 contains a short account of Dr. C. Diener's Expedition to the Central Himalayas. Dr. Diener's party, which included Messrs. C. L. Griesbach and C. S. Middlemiss, of the Indian Geological Survey, left Naini-Tal on May 21st, and proceeded by Almora to Milam, the last village in the valley of the Gori-Ganga, situated at an elevation of 11,200 feet. The second week in June was devoted to the exploration of the Milam Glacier and its environs; in size this glacier may be compared to the Aletsch Glacier. On June 19th the travellers started northwards with 20 coolies, 43 yaks, and a herd of sheep and goats. They crossed the Utadurrha Pass (17,590 feet), and spent a fortnight in and about the Girthi Valley. Early in July they succeeded in penetrating to the little explored district of Hundes (Tibet), by way of the Kiangur and Kioghar-Chaldu Passes, whose heights are 17,000 feet and 17,440 feet respectively. The following peaks (among others) were ascended:—Chitichun, No. 1 (17,740 feet), four times, Chanambaniali, No. 1 (18,360 feet), Chanambaniali, No. 2 (18,320 feet); Kungribingri (19,170 feet), was ascended by Dr. Diener alone. At the end of July, after having been confined to their camp at an elevation of over 17,000 feet for three days by a snowstorm, the party crossed the Kungribingri Pass (18,300 feet), the Jandi Pass (about 18,400 feet), and the Utadurrha Pass (117,590 feet), and regained British territory. Some opposition on the part of the Tibetans having been overcome, the travellers started on August 13th for Barahoti and Rimkin-Paiar. The Utadurrha and Kiangur Passes were recrossed, the Shalshal Pass visited on August 20, and the next fortnight spent in and about Rimkin Paiar. The first week in September was spent on a visit to Niti, reached by way of the Silakank Pass (17,800 feet). An excursion to the Niti Pass (16,628 feet) took Dr. Diener once more on to Tibetan territory, after which the return journey was made through the Dhauli Ganga and Alaknanda Valley, and by way of Ranikhet to Naini Tal, reached on October 7. In view of the scientific aims of the undertaking, purely mountaineering exploits were few. Still their stay of some weeks in the neighbourhood of Nanda-Devi (25,600 feet), the chief peak of the Central Himalayas, gave the travellers a glimpse at least of the grand scenery of these mountains. For four weeks they never camped below 14,500 feet; provisions and fuel were frequently difficult to obtain. The weather was very bad; August had twenty-six rainy days; and furious storms swept the Tibetan slope of the main chain almost continually. As regards mountain sickness, the experiences of Dr. Diener's party unfortunately were more like those of Mr. Whymper than those of Mr.

Conway. It is remarkable, however, that their sufferings were frequently greater at 17,000 feet than at higher levels. Dr. Diener has just returned to Vienna.

Further work accomplished by the Indian Survey Parties.—We learn from recent official information that in Bengal, during the last field season, No. 2 party completed 498 square miles of cadastral survey and 297 square miles of traverse survey in Chittagong, besides 150 square miles of traverse survey in the estates of the Rajah of Hill Tippera. In Orissa, No. 8 party completed the cadastral survey of 1773 square miles (inclusive of 364 square miles of revision survey in the irrigated area of district Cuttack) and traverse survey of 2009 square miles in districts Puri, Cuttack, and Balasore. Among the operations to be undertaken during the ensuing field season we learn that a detachment will be formed from the present Behar Traverse Detachment to undertake the resurvey of the Indus River in Sind.

AFRICA.

Projected Central African Telegraph.—The British South African Company has carried a telegraph line through Mashonaland from the borders of Cape Colony to Fort Salisbury, and the line is being extended across the Zambesi to Blantyre. From this point Mr. Cecil Rhodes proposes to construct a line along the great meridional furrow of Central Africa by the side of Lakes Nyasa and Tanganyika to terminate for the present in Uganda, but he contemplates ultimate extension down the Nile valley to connect with the Egyptian system. There are no physical obstacles in the path of the proposed line; perhaps the most serious difficulty will be found in procuring telegraph posts that will resist the white ant. The natives, whose territory would be traversed, are of a peaceful character, and in great part already in the initial stage of civilisation through the labours of European missionaries. It may be a question whether the saving in expenses for maintenance might not justify the use of a light cable along the bed of Lakes Nyasa and Tanganyika, and across the Victoria Nyanza. Into the financial aspects of the project it is not our duty to enquire, but that the subject has been deemed worthy of geographical consideration is plain from the fact that a substantially similar scheme was discussed and reported on by a Committee of Council of the Royal Geographical Society twelve years ago. At the time when the scheme was first suggested the Egyptian government could guarantee the maintenance and protection of the line from Egypt to the Victoria Nyanza, and there was then no cable to Cape Town or Zanzibar. Hence the value of the line would have been very great. Africa has now been practically encircled by cables, and there is no necessity for running the overland line from the head of Lake Nyasa to Bagamoyo for communication with Zanzibar, and

thence back to the Victoria Nyanza as suggested in the report of the committee referred to. Full particulars of the earlier scheme will be found in Vol. XXI. of the old series of *Proceedings*, p. 616, and in the *Proceedings*, new series, Vol. I. (1879) pp. 123, 217, 264–271 (the Committee's Report).

Diogo Caõ.—It has always been supposed and affirmed that Diogo Cao, in 1484, discovered the mouth of the Zaire or Congo River, erecting on its left bank a stone pillar with the arms of Portugal, and an inscription in Portuguese and Latin (Barros), or in Portuguese, Latin, and Arabic (Pacheco), and two other pillars, also between 1484 and 1486, further south, on Capes St. Augustin (Santa Maria), and Negro, which pillars were called *Padraõs*. The stone pillar of the Zaire or Congo River was, says Señor Cordeiro, in the *Boletim* of the Geographical Society of Lisbon, broken some time before 1859, by the cannon shot of an English man-of-war. The fragments of the other two were brought back to Portugal in the beginning of the present year, and are to be seen in the rooms of the Lisbon Geographical Society. Señor Cordeiro has now deciphered and published, in *facsimile*, the inscription, which is written only in Portuguese, of the Padraõ of St. Augustin, (13° 27′ 15″ S., not 15° 50′ as Major says). It is thereon said that the year of its erection and, therefore, of the discovery of the Zaire or Congo River, was 1482. Diogo Caõ's third and last Padraõ was erected on Cape Negro (15° 40′ 30″ S., not on Cape Cross, as Major says).

Progress in Nyasaland.—Our last letters from Nyasaland announce that quiet was still prevailing among the natives in the Shiré Highlands, and that many Europeans were arriving to take up land for coffee-planting. The British gun-boats for Lake Nyasa were expected to arrive at the Chinde mouth of the Zambesi, on October 5th, and to be on the Upper Shiré, ready to be put together early this year, before the commencement of the rainy season. It was supposed that Commander Keane, R.N., would be sent out to superintend the work. Meanwhile Capt. Sclater was making great exertions to improve the road between Katunga's and Blantyre, up which the gun-boats would have to be carried. This route rises 2,000 feet in the first 10 miles, and the work upon it is said to be fearfully heavy. It was very difficult to get the natives to work at it at all. They do not object to hoeing and clearing land, as that they are used to; but why a road should be required is more than they can comprehend, and many of them refuse to work at this kind of labour. Herr Wissmann and the German gun-boat were still slowly ascending the Lower Zambesi, and it was hoped that the British vessels would be launched on Lake Nyasa before the German gun-boat was ready. In accordance with orders from H.M. Commissioner, Capt. Sclater had made a short journey from Blantyre into the valley of the Moanza, which joins the Shiré opposite Mbewé. The

intervening range was found at this time of year to be nearly waterless. At Mikolongo in the Upper Moanza valley, where the chief Kavira resides, he had met with M. Foa, an agent of the Central African Company, who claim large tracts of land on the south side of the Shiré. Two neighbouring chiefs, who were proposing to settle a long-standing quarrel by fighting it out, were visited and warned that such practices could no longer be permitted within the British "sphere of influence." Capt. Sclater returned to Blantyre down the Moanza valley. The first collections made by Mr. Alexander Whyte, the naturalist attached to Commissioner Johnston's staff, have arrived in this country, and have been carefully examined by various experts. They are mostly from the high ranges of Zomba and Milanji, and contain many novelties. Dr. Günther's report on the reptiles and that of Mr. Oldfield Thomas on the mammals were read at the Zoological Society's meeting on November 1st last year and will shortly be published in that Society's *Proceedings*. Among the reptiles are examples of three new species of chameleons, two of which—one belonging to the genus *Rhampholeon*—are remarkable for their extremely short tails. A paper by Capt. Shelley on Mr. Whyte's collection of birds from the Shiré Highlands, appears in *The Ibis* for the present month. Representatives of twelve new species were in the series, amongst which is a new song-thrush from Mount Milanji (*Turdus milanjensis*). The plants, which have been examined by the officers of the botanical department of the British Museum, likewise present many features of great interest. The large coniferous tree of Mount Milanji, described by Mr. Whyte as a cypress (see *Proceedings*, R.G.S. 1892, p. 472), turns out to be a new *Widdringtonia*, which has been named after its discoverer *W. whytei*. A complete set of all the collections has been presented to the British Museum.

Dr. Stuhlmann's African Work.—Probably few amongst those who scan the map of Africa or listen to the record of travel in that continent realise the enormous amount of labour involved in filling in the details of only a small corner of unexplored land. The *Deutches Kolonialblatt* gives a brief summary of the cartographic material accumulated by Dr. Stuhlmann, which effectively illustrates the activity in observing and recording demanded of an explorer who is at the same time a geographer. The list of the material brought back is as follows:—A route-map of 146 octavo sheets, showing the journey from Kafuro to the most northerly point reached in Southern Momfu. The direction of the line of march is noted at intervals of five minutes, and many thousand compass-bearings taken to distant mountains and other conspicuous objects. A series of profiles of hill-slopes, and of the country generally, comprising no less than 105 sections of the country between Kafuro and the west of the Albert Lake. A journal containing a transcript of the geodetic measurements about Bukoba, with numerous

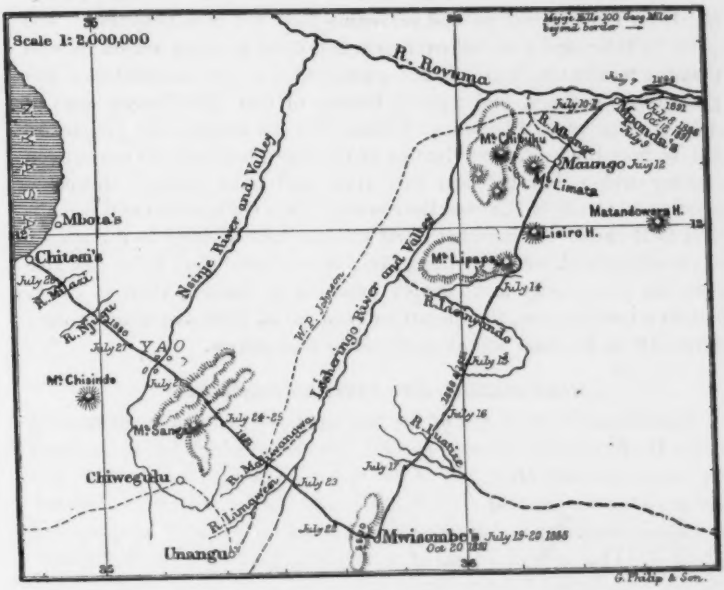
compass bearings, including also observations on the return journey to Muanza, in which many of the islands in the south-western part of the Victoria Nyanza had their position fixed. Two small journals, with original entries of the route to the coast at Bagamoyo. A map of the route from Muanza to Bagamoyo on the scale of one minute of marching to a millimetre. This occupies forty-six sheets, with a total length when put together of 40 feet. It was accompanied by thirteen tables, showing mountain profiles. About twenty-four sketch-maps incorporating some of the facts in a provisional way for special regions, drawn on the spot. A curve showing sixty-five astronomically-determined positions and magnetic observations. Finally, there was a large folio volume, partly filled in by Emin Pasha and continued by Dr. Stuhlmann, giving all the estimates of height, boiling-point readings, and meteorological observations, extending to about 70,000 separate entries. Besides this purely cartographic material, the expedition brought home large collections of specimens in different departments of natural history, voluminous notes on the people met with, and vocabularies of twenty different languages. When it is remembered that careful collation and often laborious calculations are necessary before a correct map can be constructed from the data collected, one cannot be surprised at the fact that years are frequently necessary before a book of true geographical travel can be presented to the public.

Death of Cardinal Lavigerie.—We must record the death at Saint Eugene, near Algiers, on November 26th, of Cardinal Lavigerie, whose active exertions against the African slave trade are so well known. He was seventy-seven years of age, and for the last thirty years has been the most energetic organiser of the French missions. He founded the mission of the "White Fathers" and "White Sisters" in 1868, and in 1888 he convened the great International Anti-Slavery Conference, from which the Belgian Anti-Slavery Society resulted.

Return of Captain Monteil.—Captain Monteil and his companion Badaire, whose arrival at Tejerri from Lake Chad we noticed last month, have reached Paris, where they received a most cordial reception on December 20th.

On a New Route from the Rovuma to Chitesi on Lake Nyasa.—The Very Rev. Archdeacon Maples sends us a map of the routes which he followed in 1886 and 1891 in his journeys from Mponda's, on the Rovuma River to Chitesi's on Lake Nyasa. He writes: "I place Unangu rather differently from where the Rev. W. P. T. Johnson placed it (see Mr. Johnson's map in *Proceedings* of the Royal Geographical Society, September, 1884), but he inclines to think that my placing is right and his wrong. I give the course of the Losheringo west of his placing. He thinks I am probably right there too. I

notice that many of the places on the coast of Lake Nyasa are marked wrongly (on Mr. Johnson's map), *e.g.*, Morumba and Masanje are one and the same place; but I believe we have a correct map of the coast-line, and for all the rest you had better follow his map, except



when I differ from his original placing of Unangu (mark the spelling) and the Losheringo (or Lucheringo). I send you my torn and tattered map. I made it first in 1886, and used it again in 1891. I thus tested it and believe it to be fairly correct."

Lieutenant C. H. Villiers' Expedition in North-East Africa.—News has been received that the exploring party, consisting of Lieutenant C. H. Villiers, Royal Horse Guards, Sir Henry Tichborne, Dr. Mackenan, Lieut. J. M. Bennett-Stanford, and Mr. Harris, which left England in October last, had been successful in collecting stores and camels at Aden and Berbera, and was on the point of starting down the coast to the mouth of the Juba river, where the stores, etc., would be transhipped to the I. B. E. A. Co.'s stern-wheel steamer *Kenia* and taken up the river to the head of navigation. Mr. J. W. Gregory, Assistant in the Geological Department of the British Museum, has since left England to join the party as Naturalist, leave of absence, on full pay, having been granted to that gentleman for eleven months. Lieutenant Villiers, the leader of the party, has on a previous occasion visited Somaliland and travelled

from Berbera as far south as Melmil, and both he and Mr. Gregory have received instruction in surveying and practical astronomy at this Society's observatory under Mr. Coles. One of the principal objects of the expedition is to obtain sport; but as portions of the country through which it is proposed to travel are entirely unknown, the necessary instruments for fixing positions and surveying have not been forgotten. The party in this respect is well equipped, and there is every reason to hope that the results obtained will add considerably to our knowledge of the geography, geology, and natural history of this little-known part of Africa. The route Lieutenant Villiers and his companions propose to follow, from the head of navigation of the Juba, is across the unexplored country which lies between this river and Lake Rudolf; thence, if possible, to return N.E. across the country of the Galla tribes and Somaliland to Berbera. A somewhat novel incident has occurred in the matter of providing food for the porters, etc.; it was found that dates and rice could be more easily and cheaply procured in London than at Aden, and, as a consequence, the quantities required of these two articles were purchased in England and shipped out to East Africa.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Measurements of an Arc of the Meridian.—M. L. Bassot summarises in the *Comptes Rendus* the new geodetic operations which have completed the remeasurement of an arc of the meridian decided on in 1869, and undertaken after the war of 1870. General Perrier, afterwards assisted by Captain Defforges and M. Bassot carried out the work. The operations included (1) the establishment of a complete chain between the Spanish frontier and Dunkirk, bringing it into relation as far as possible with each of the parallel chains of the old survey; (2) the redetermination of the coordinates of the Pantheon, the starting-point of the French triangulations; (3) the measurement of the base lines in terms of the standard metre; and (4) the calculation of the length of the arc and the corrections of previous measurements which directly depended on it. The work is now practically finished, and the French triangulation is connected by actual observation with the surveys of England and of Spain. The recalculation of the main lines of the network of French survey shows complete accordance with the triangulation of England, Italy, and Belgium; but a discrepancy with that of Spain amounting to $\frac{1}{63000}$. The total length of the meridian between the extreme points which have been fixed astronomically, a distance of about 8° 17′, is only 16·4 feet less than that calculated on the assumptions of Clarke's ellipsoid, which assumes a polar flattening of $\frac{1}{293\cdot46}$. This theoretical value is thus confirmed. The new measurement between the extreme point shows the length to be 146·6 feet, or $\frac{1}{20000}$ greater than was deduced by Delambre when measuring for the value of the metre at the end of last century.

Observatory on Mont Blanc.—M. Janssen has reported to the Paris Academy of Sciences on the progress made this summer with the work of erecting an observatory on the highest summit in Europe. Two tunnels, 75 feet long, have been driven through the ice, about 40 feet below the summit, horizontally, from different sides, at an angle of 45° to each other but without reaching rock. The possibility of a rock foundation being thus made very doubtful, it was decided to build the house on the snow. To test the conditions of compacted snow, M. Janssen experimented last winter with an artificial snow mound at the Observatory at Meudon. He levelled the surface of this mound, and placed on it discs of lead 14 inches in diameter and weighing about 66 lbs. each. The impression in the snow made by twelve such discs weighing altogether nearly 800 lbs. on an area of about one square foot, was barely one-third of an inch. It is proposed to make the observatory in the form of a truncated pyramid, the whole lower storey being embedded in the snow, thus securing a relatively large base to resist the pressure of the wind on the upper part. The base of the rectangular wooden building would be 33 feet by 16 feet 6 inches, and trap-doors in the floor would permit of the adjustment of screws by which the exact position of the structure could be maintained in spite of slow movements of the ice. The walls, windows, and doors would all be double to secure warmth. An observatory on this plan has been built and conveyed to Chamonix; most of it has been carried in sections to the Grands Mulets, and about one-quarter has been taken to the new hut on Roches Rouges only 980 feet from the summit. Next year should see the work completed, and volunteer observers will not be wanting to study the many interesting questions which the unique position of the new observatory brings within the reach of science.

Time Standards.—M. E. Lullin, a Swiss engineer, publishes a pamphlet on time standards for the world, in which he states the case against the adoption of the hour-zone system. One grave objection on the continent of Europe is, the difficulty of adopting any standard based on the meridian of Greenwich; another and more practical difficulty is the abrupt change of one hour from zone to zone. The plan proposed is that each town should employ its own local time, and for international purposes universal time should be used, a constant correction sufficing in each case to make the change. Universal time should be reckoned from a neutral meridian, and M. Lullin proposes that traversing Bering Strait and the Central Pacific on one side and Central Europe (12° 30′ East of Greenwich) on the other, the Pacific meridian would be 0°, the European 180°, but to complete the system all longitudes would be reckoned in their time-equivalents. Thus by making midnight of universal time that of the Pacific meridian, the longitude of any place in hours, minutes, and seconds of time, is the

correction to be applied to the local time to bring it into harmony with the universal. The scheme is worked out with numerous examples. A defence of the principle of local time also appears in the current number of the *Journal* of the Manchester Geographical Society: but in spite of all that can be said for this system, it is unlikely to be generally adopted. The fact that so large a portion of the Earth's surface has already adopted the hour-zone reckoning from Greenwich (*Proceedings*, 1892, p. 465) is enough of itself to ensure the ultimate adoption of that system everywhere.

CORRESPONDENCE.

*The Position of Salaga, West Africa.**

SALAGA, *October 8th*, 1892.

TO THE ROYAL GEOGRAPHICAL SOCIETY, LONDON.

The geographical position of Salaga in the Hinterland of the Gold Coast, West Africa, has been frequently discussed. The discrepancy between different maps as to longitude amounts in some cases to 50′. Personally, I am convinced that Capt. Binger's longitude is wrong to a considerable extent. If it were right, the magnetic variation on the way from Akra to Salaga would be easterly, not westerly, and a large portion of Dahomé would have to be attached to the colony of Lagos. As a matter of fact, there is no place on the Gold or Slave Coasts the position of which has been really satisfactorily determined; and we may look for errors of from 1′ to 3′ in the generally accepted positions.

I beg to draw the attention of the Council of the Royal Geographical Society to this matter, in the hope that they may use their influence in the proper quarter in order to have the positions of certain places—say Akra on the Gold Coast, Lagos and Akassa on the Slave Coast finally determined by telegraph.

I remain, &c.,

GOTTLOB ADOLF KRAUSE,

Ada, Gold Coast.

OBITUARY.

Major-General Shdanoff.—We regret extremely to have to announce the premature death of Major-General Shdanoff, chief of the Topographical Section of the Caucasus Military District, who was elected an Honorary Fellow of the Society only last summer. As director of the Caucasian Survey, General Shdanoff rendered great services to cartography and travellers. He was instrumental in carrying out the resurvey of the mountain region which is still in progress, and of which some of the first fruits in the shape of preliminary sheets have from time to time reached the Society. One of his last acts was to send two sheets of this survey to our Secretaries, who received them after the news of his death. In the new map the physical features of the chain are for the first time laid down with any approach to accuracy in

* Translation.

detail. The aim of the surveyors has been high. Messieurs Jokoff, Bogdanoff, and Golombievsky, and their fellow-workers have not been content to improve on the old 5-verst map; they have made it their endeavour to produce the materials of a map which may rival the best mountain surveys of Western Europe. In a very interesting and detailed letter written to Mr. D. W. Freshfield, a few weeks before his fatal illness, General Shdanoff set out his scheme for the publication of the new map, and expressed his earnest hope that he might be provided by his Government with funds adequate to ensure its rapid completion. The following quotation from it will be read with interest and sympathy :—

"The Council expresses the hope that by the date of the Geographical Congress in 1895 specimen sheets of a new map of the Caucasus will be ready—meaning the new 5 verst to an inch map. I have begun, in fact, to prepare a new edition of the 5 verst map; but the whole advances very slowly on account of the few workers in our topographical section, especially as regards engraving.

"The division of the new map into sheets will be the same as before, so that each sheet of the new map might be substituted for the corresponding old one. The mountains will be rendered by contour lines. The printing is proposed to be done in four colours, or even five: (1) the mountains; (2) the forests; (3) the rivers; lakes, and snowfields; (4) the other physical features and all letterpress. A fifth colour may be used in time to mark administrative frontiers and the districts.

"The originals of the new sheets are prepared for each colour by photographic reproduction directly from the survey sheets."

It is to be desired in the interest of geography that the Russian Government may be fortunate in finding a successor to General Shdanoff, equally imbued with scientific zeal, and as generous in assisting independent explorers of whatever nationality.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1892-93.

Special Meeting, November 24th, 1892.—General Sir C. P. Beauchamp Walker, K.C.B., in the Chair.

Before the reading of the paper the Chairman made the following remarks :—

We have been—I speak for the Council—under some small difficulty as regards Captain Lugard's last lecture. A great many of our Fellows—an appreciable number at any rate—were disappointed of entrance, but I hope all those who were have received tickets which will enable them to be present to-night. The fact is, this hall is lent to us by the London University, and is the only place at which our lectures can very well take place; but it will only hold a certain number, and when more come it must naturally overflow. As Captain Lugard generously consented to read his paper again, the Council hope that all difficulties are now arranged.

Captain Lugard then repeated his paper on

"A Journey from the East Coast to Uganda and the great Equatorial Lakes of Africa."

After the reading of the paper the following remarks were made by Mr. H. M. Stanley :—

If this were a political meeting I should have a great deal to say, but I must confine myself strictly to geographical talk. I have followed Captain Lugard with

excessive interest every step that he has described. I have to disagree with little or nothing that he has stated. I find that if I *had* wanted to discover what kind of man he was, his lecture would have enabled me to discover pretty clearly that he was very sociable, painstaking, and thoroughly human. All that he has stated in regard to these fine tribes on the plateau of Equatorial Africa, north of the Victoria Nyanza, and up to the Albert Edward and the Albert I heartily agree with. He brought to my mind very frequently in his description the Wahuma, the finest people in Africa physically, though the Waganda undoubtedly are superior to the Wahuma mentally. From the Cape to Cairo there are no finer people to be found than within that interlake region. I see that there is a little difference in the formation of the Albert Edward; instead of looking like a handleless teapot, it has turned out to be something resembling a narrow coffee-pot. He explains that he only took a compass with him, and I suppose if he added magnetic variation he would find the spout-like formation going further towards the west. Also the map-maker has done an injustice to Ruwenzori by putting down such a small dot for the Great Snowy Mountain. I see the Aberdare Range marked clearly, but Ruwenzori, really very much larger, is marked as a very small pin-point on the map. I quite understand, of course, that the map-maker intended only to illustrate the lecture; nevertheless, as some of you might go away with a wrong impression of its greatness and vastness, you should remember that three-quarters of the distance between those two lakes ought to have been occupied by Ruwenzori. I see also that Lake Victoria is gradually becoming more and more circumscribed; by-and-by I am afraid it will disappear altogether. It is not the first time that such freaks have taken place; for centuries the Mountains of the Moon have been dancing over the breadth of Africa, and I suppose some day they will begin to do so again. I thought I had anchored them steadfastly near 30° E. long. I am not at all disinclined to see Lake Victoria gradually becoming circumscribed, because in 1875—something like seventeen years ago—I was a young beginner in African exploration, and though I did spend two or three weeks in being taught the art of navigation, &c., which I had to practice daily, I bothered my head more about the east side of Lake Victoria than I have done upon any part of Africa since, and therefore I am quite ready to believe that I may be 10, 20, 50, or 100 miles even out of my way; but about Ruwenzori and the Albert Edward I stick fast to my guns; also about the course of the Congo and the latitudes of the north and south ends of Tanganyika I will not budge a hair's-breadth. I was very much interested, as I state, in hearing Capt. Lugard's address. I wish he had given us more of it. I would have infinitely preferred to have heard an enlarged description of these fine countries in Central Africa, and I should have wished he had curtailed a few descriptions of the tribes and routes towards the east. We should have had more, I may say, of the juice of Africa, for certainly if old Africa is to be saved at all, it is because of the merits and lands of the people of inner Africa, that is, those lying between the Western escarpment and its eastern face. You have heard him say how he passed through a tract of 250 miles waterless country east of Usoga. I doubt whether you will find a single square mile of waterless tract on the Interlake plateau, except near Lake Albert Edward, and that may be accounted for by the late recession of the Lake. In other things between Lake Albert Edward and Kavalli he has corroborated our discoveries. You can imagine then how very interested I was in hearing those descriptions, and it is a pleasure to me to have seen the second explorer of those regions. Captain Lugard has said that he did not care very much for the honour and glory of becoming an explorer, but he certainly has proved that he has not travelled without showing considerable merit. I hope that I may say one word or two without offending the instincts of geography manifested in this society. I

hope the words which Captain Lugard has addressed to this Society, to London, and to all England, will impress themselves upon the minds of the people, and that little by little we shall get the nation to share our deep, sincere and earnest sympathy with the condition of these Equatorial African peoples.

A vote of thanks to Captain Lugard was proposed by the Chairman, and carried unanimously.

Second Ordinary Meeting, November 28th, 1892.—The Right Hon. Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., President, in the Chair.

PRESENTATION.—*Miss Maria Eleanor Vere Cust.*

ELECTIONS.—*Arthur Rodolph Nunn Agassiz; Alexander Armstrong; Rev. Francis Henry Baring, M.A.; Walter R. Durie Beckett; Mrs. Isabella L. Bishop; T. H. Browne; T. A. Bullock; Captain George Vernon Burrows (Indian Staff Corps); Alfred Richard Edward Burton; Samuel B. Burton.; Albert F. Calvert; Rev. Jesse Carey; Captain Alfred E. J. Cavendish (1st Arg. and Suth. Highlanders); Joseph Charlesworth; Godfrey John Boyle Chetwynd; Percy Church; Mrs. Zelie Isabelle Colvile; Ernest Edward Cook; Thomas Albert Cook; Saxton Campbell Cory; Godfrey Michell Courage; Rev. Henry Thomas Cousins; Alfred Ernest Crawley, B.A.; The Right Hon. the Earl of Cromartie; Laurence Cussen; Miss Maria Eleanor Vere Cust; Otto Vernon Darbishire, B.A.; Miss S. Agnes Darbishire; John Delacour; Mrs. Cotterell Dormer; Lieutenant Philip Wylie Dumas, R.N.; Frederick Dutton; Viscount Falmouth, C.B.; George Frederic Gibson; George Godfrey Gray; J. Errol Gray; Frederic Hannam-Clark; Frank Arnold Harger; T. Sidney Hargreaves; Frederick Rutherford Harris; Andrew J. Herbertson; W. T. Hill-Cathrine; Theodore Hoffmann; Charles Hose; Alfred Jackson; Mrs. Jackson; Mrs. Beatrice Hope Johnstone; George Lawson Johnston; Henry Edward Joyce; James Johnston Keswick; John Kitching; Raphael Kuhe; Richard Lace; Herbert Lawton; Richard Cecil Leigh; J. Lightfoot; William May Lindsay; Reginald Livesay; James W. Lowther, M.P.; Mrs. Edward Maberly; Wallace Maclaren, M.A.; Miss Kate Marsden; Eduardo de Martino; Captain A. H. McMahon; Rev. W. A. Mill; Dr. Joseph A. Moloney; Mrs. Juliet Mylne; Captain Matthew Nathan, R.E.; Captain J. S. Nicholson (7th Queen's Own Hussars); Samuel Walter Norton; Thomas B. Nowell; Mrs. O'Conor; Major Edward Roderic Owen (Lancashire Fusiliers); Alfred Edward Pease; Lieutenant Cecil Pereira (Coldstream Guards); George S. Perrin; Lieutenant Arthur L. Pilleau (2nd Bombay Lancers); Mrs. Emmeline Porcher; Captain Powell (1st Ghoorkas) Charles John Powlett; Miss Christina Maria Rivington; William Henry Denham Rouse; Thomas Rowe; Thomas Rudd; Major William Charles Eldon Serjeant (Rifle Brigade); Mrs. French Sheldon; Henry Gustavus Simon; F. H. Smiles; G. C. Smith; George E. T. Smithson; Charles Soppit; William Stanford.; John W. De Vere Stevens; William Stigand; Captain William Storm; Lieutenant H. W. Studd (Coldstream Guards); Paul Thiemé; Surgeon-Captain W. G. Thorold (Indian Med. Service); M. Tighe; Colonel Charles V. Verelst (Late Commanding 11th Hussars); Arthur T. Walker; John Claude White; L. Whitehouse; Major George Wingate (Bengal Staff Corps); Harold Richard Wintle; Rev. Alfred Cecil Wright; Lady Fox Young.*

The paper read was:—

"To Lake Bangweolo and the Unexplored Region of British Central Africa." By Joseph Thomson.

Maps and photographs were exhibited in the tea-room.

Special General Meeting, November 28th, 1892.

This meeting was summoned by the Council by the following notice which was sent to all Fellows in Great Britain:—

A Special General Meeting of the Fellows will be held on Monday November 28th, at 4.30 P.M., in the Hall of the University of London, Burlington Gardens, W., for the purpose of revising the Rules of the Society in accordance with resolutions of the Council. It will be proposed to lower the Commutation Fee in the case of Fellows of long standing, and to raise the Entrance Fee to 5*l.* and the initial Life Commutation Fee to 35*l.*

DOUGLAS W. FRESHFIELD, HENRY SEEBOHM, *Hon. Secs.*

The PRESIDENT: Before proceeding to our immediate business I desire to congratulate the Society upon the remarkable state of prosperity in which it finds itself. On the corresponding night of last year I was able to announce that seventy new members had been added to the Society, to-night I am able to announce that 109 new members have been added. I was able to say on the corresponding night of last year that there were nine new candidates for admission to the Society, to-night I am able to say that there are forty-one new candidates for admission to the Society. I think you will all consider that this is extremely satisfactory, and satisfactory chiefly for two reasons. The first reason is because in my annual address in the summer I had to announce that our losses by death had been most unusual. We therefore required an unusual accession to make up for these losses. There is another and very important reason for welcoming the inflow of new members. Our possessions of various kinds—our books, our maps and diagrams, and photographs—are growing so rapidly that we are in danger of being turned out of house and home. Before very long the officers of the Society will have to make some definite proposal about change of locality—change of locality which will undoubtedly involve considerable expense. It is within the knowledge, I suppose, of all present that the house No. 1, Savile Row, is our freehold property. Of course the first idea to occur to our minds was that it would be well to buy some of the adjoining property. We have tried to do so, but we have found it impossible, and if it were possible there is this further difficulty that at a period not at all distant, when talking of the life of a Society, it is more than probable that a street may be run through our present premises. That being so we have been led to look about in various directions. We applied to the late Government to help us, as it and its predecessors helped so many other scientific societies less directly useful to the State, by giving us a site, or, if unable to give us a site, then by selling us a site, or letting us a site, upon some reasonable terms. We do not by any means despair of sooner or later getting a favourable answer, but up to the present time we have not received such an answer. We have enquired as to the cost of property in Central London, as to the possibility of buying a site and raising a building on some of the leading thoroughfares not very far away from where we are now. I regret to say that we have found the probable expense greater than we had reckoned on. We are afraid that a site in one of the leading thoroughfares in the centre of the town, large enough to contain all that we want, including a hall (this hall, of course, is only lent us by the kindness of the University of London), would amount to a figure of not less than about £40,000. Then there would be the building, which must come to something very like the same figure. Altogether we should have to spend, if we remained in this part of the town, not less than £80,000—that is to say, we should have to expend twice our present property. The property of the Society, including the value of our present premises, but exclusive of their contents, is worth something like £40,000. These figures are not very encouraging. We are not yet in

a position to come before the Society with any definite proposal, and it is not necessary that we should do so at present; but the reason I mention these things is, first, that they have a bearing on any change we may make in reference to Chapter IV. of our Rules; and next, I want to take this opportunity of asking Fellows of the Society who may have influence to do all they can to try to bring it to bear on the Government, so as to induce it, if not to give us all we want—at least, to meet us half-way. If this prove ineffectual, I should ask them to consider and to communicate with us, not in any formal manner, but by conversation or letters, when the matter comes into their minds, as to whether they think we could, with advantage to the Society, go to any other part of the town where property is more easily acquired. These are the matters that I wish to mention of a preliminary character. The regular business, as you know, will be to go through these rules which you all have in your hands, and the history of our asking you to do so is this:—The rules have not been reprinted since the year 1879. In the thirteen years that have passed since that time, a number of small and very trifling variations have gradually been adopted in practice. These it is desirable formally to recognise; but the primary object of the meeting is to consider the resolutions of the Council with regard to raising the entrance-fee and commutation-fee on entrance, and introducing a graduated commutation-fee for the benefit of Fellows of long standing. The latter change is proposed in consequence of the frequent applications received from Fellows, and the Council believe that the financial changes they propose will, as a whole, give a reasonable boon to our senior members without risk to the resources of the Society. I will now put them to the Society in the form in which they are likely, I think, to give least trouble.

The alterations proposed were put, and carried.

The following is the new rule with regard to entrance and commutation fees:—

"Every Ordinary Fellow shall, on election, be required to pay £5 as admission fee, and £2 as first annual subscription, or may compound either at entrance by one payment of £35, or at any subsequent period on the following basis:—

Fellows of 20 years' standing and over	.	.	.	.	£12	10s.
„	15	„	„	and under 20	.	.	.	£16
„	10	„	„	„	15	.	.	.	£20

And no Fellow shall be entitled to vote or to enjoy any other privilege of the Society while in arrear. Honorary and Corresponding Fellows are not required to make any payments."

Admiral Sir Leopold M'Clintock enquired whether the question as to the election of ladies had already been decided by the Council, or whether it was to be placed before the meeting?

The President replied that no question about the admission of ladies was before the meeting. A certain number had been elected by the Council under the existing bye-laws and by virtue of the powers delegated to them by the charter.

Admiral Sir Leopold M'Clintock argued that the admission of ladies involved a change in the constitution of the Society, and would not strengthen its geographical character and utility.

Mr. Douglas Freshfield, Hon. Sec., replied on behalf of the Council, pointing out that they had acted in the only way open to them under the terms of the Charter of the Society.

Admiral Halliday Cave spoke in support of Sir Leopold M'Clintock's argument.

Mr. R. N. Cust then proposed the following resolution: "That this meeting desires to associate itself with the gracious act of the Council in recognising the right of ladies to the Fellowship of the Royal Geographical Society."

Mr. J. W. BATTEN seconded the resolution and Mr. H. M. STANLEY spoke in its support.

After some further remarks from Admiral Sir L. M'Clintock, the President explained that the question of the admission of Fellows was not technically before the meeting since it had been finally settled by the act of the Council, the power of which under the Charter was incontestable. The Council were now putting before the Society changes in the rules; their interpretation was a different matter, and lay with the Council. He thought that if there was any general feeling that he should not put Mr. Cust's motion, it would not be desirable to put it. He regarded it as an act of sympathy which Mr. Cust thought it would be agreeable to the Fellows present to perform under the existing circumstances. Mr. Cust was entitled to have his motion put, he thought, to the meeting, not as business, but as a matter of courtesy.

There voted for the motion 56, against 7.

Third Ordinary Meeting, December 5th, 1892.—The Right Hon. Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., President, in the Chair.

ELECTIONS.—*Captain Edward Agar, R.E.; Charles Wilgress Anderson; Augustus Charles Argles; Claude Askew; Lieutenant H. H. Austin, R.E.; John William Bolton; Alfred Bonham-Carter; Percy M. Buchanan; Colonel Robert Bullock; Edward Litton Carus-Wilson, M.A.; Captain George Chenevix-Trench (Indian Staff Corps); W. H. Cozens-Hardy, B.A.; Captain Evens (4th Royal Fusiliers); John Frewin; Major George Edward Giles, R.A.; George E. Y. Gleadowe; Mrs. Lilly Grove; Frederick Cartwright Gubbins; Geoffrey Head; Colonel Frederick C. Henshaw (Victoria Rifles); Maurice Holtz; John Dudley Hoper; Colonel Edmund Hegan Kennard; Rev. Walter Lanceley; Robertson Lawson; Colonel Sir George Leach, K.C.B.; Frank Ledger; Arthur H. Lyell, M.A.; Lord Monkswell; E. Montague Nelson, J.P.; Rev. John W. Ogden; Francis William Percival, M.A.; Rev. Beresford Potter; Miss Florence M. Small; F. Heron Relph; James Frederick Roberts; Morley Roberts; Lieutenant P. G. Twining, R.E.; Captain George Wemyss (West Yorkshire Regt.); George Mawdsley Williams; A. F. Yarrow.*

The papers read were:—

1. "Travels in a Portion of the Kalahari Desert." By E. Wilkinson.

2. "Journeys in the Benin Country, West Africa." By Captain H. L. Gallwey (H.M. Vice-Consul to the Oil Rivers Protectorate).

Fourth Ordinary Meeting, December 19th, 1892.—The Right Hon. Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., President, in the Chair.

ELECTIONS:—*John H. Fryday Brabner; William Burdett-Coutts, M.P.; James Crombie; Charles E. Hobhouse; Francis Blackburne Hopkins; Professor D. E. Hughes, F.R.S.; A. Joshua; Commander Henry Keane, C.M.G., R.N.; Arthur Ernest Spencer; F. C. im Thurn; J. C. im Thurn; Albert Henry Turton; James Wallis; John White; William Wilson.*

The paper read was:—

"Expedition up the Jub River, through Somali Land." By Commander F. G. Dundas, R.N.

A collection of curios, photographs, and maps was shown in the tea-room.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

EUROPE.

Danube. **Bigelow.**

Paddles and Politics down the Danube. By Poultney Bigelow. London, &c., Cassell & Co., 1892: cr. 8vo, pp. 253. *Price* 3*s.* 6*d.* *Presented by the Author.*

An account of a canoe trip down the Danube, in the summer of 1891, with discussions of Danubian politics, illustrated by original sketches.

England—Winchelsea. **Inderwick.**

The Story of King Edward and New Winchelsea. The Edification of a Mediæval Crown. By F. A. Inderwick, Q.C. London, Sampson Low, Marston & Co., 1892: 8vo, pp. xiii. and 219.

The geographical position of Winchelsea is of great interest on account of the rapid extension of the shore in modern times, of which this attractive little book gives a good account in tracing the resulting historical changes.

Faroe Isles. *Deutsche Rundschau* **15** (1892): 21–27, 113–122. **Jiriczek.**

Die Färöer. Von Dr. Otto Luitpold Jiriczek in Stockholm.

Dealing with the scenery, people, and language of the Faroe Isles.

France—The Causses. *Compt. Rend.* **115** (1892): 742–743. **Martel and Gaupillat.**

Sur la rivière souterraine du Tindoul de la Vayssière et les sources de Salles-la-Source (Aveyron), Note de MM. E. A. Martel et G. Gaupillat.

The source of the perennial and intermittent springs of Salles la Source has been traced to a great subterranean reservoir with restricted outlets on the underground course of the river of the Tindoul.

France—Caverns. *Revue de Geog.* **16** (1892): 355–362. **Martel.**

La grotte de Saint-Marcel-d'Ardèche.

Continuation of M. Martel's underground explorations, with plans and sections.

France—Poitou. *Ann. Geog.* **2** (1892): 53–61. **Welsch.**

Essai sur la Géographie physique du seuil du Poitou. Par Welsch, Professeur de Géologie à Poitiers.

The relation of the geography to the geology are explained by the aid of diagrams.

France—Seine. *Rev. Marit. et Colon.* **115** (1892): 560–580. **Dormoy.**

Notions sur le Mascaret de la Seine. Par M. Dormoy, chef du pilotage de la basse Seine.

A practical and theoretical discussion of the phenomena of the bore in the Seine.

France—Seine. *Ann. Geog.* **2** (1892): 27–45, *with geological map.* **Lemoine.**

Etat actuel de nos connaissances sur l'hydrometrie du bassin de la Seine. Par Georges Lemoine.

M. Lemoine explains that hydrometry is the most exact form of hydrology, which is itself a more precise hydrography, and he summarises the hydrometrical conditions of the Seine with great ability.

Germany—Altmark. *Mitt. Verein Erdkund. Halle* (1892): 1–47. **Mertens.**

Die südliche Altmark. Von Dr. A. Mertens in Magdeburg.

The physical geography of the district between the Elbe and the Harz.

Germany—Baltic Lake-Ridge. *Ausland* **65** (1892): 673–676, 694–696, 710–713. **Ule.**

Die Seen des baltischen Höhenrückens. Von W. Ule.

Germany—Harz Mountains. *Mitt. Verein. Erdkunde Halle* (1892): 150–172. **Kloos.**

Die Höhlen des Harzes und ihre Ausfüllungen. Von Prof. Dr. J. H. Kloos in Braunschweig.

Germany—Schleswig. *Peterm. Mitt.* **38** (1892): 256–259 (*Map*). **Langhans.**

Die Sprachenverhältnisse in Schleswig. Von Paul Langhans.

On the distribution of the Danish, German, and bilingual population of Schleswig.

Germany—Thuringia. *Mitt. Verein. Erdkunde Halle* (1892): 84–149. **Grössler.**

Führer durch das Unstrutthal von Artern bis Naumburg für Vergangenheit und Gegenwart. Von Prof. Dr. Hermann Grössler in Eisleben.

A specimen of minute local geography, only the upper half of the Unstrutthal, from Artern to Nebra, being described. Historical as well as topographical information is given regarding all the hamlets passed.

Greece. **Rodd.**

The Customs and Lore of Modern Greece. By Rennell Rodd, with 7 full-page illustrations by Tristram Ellis. London, David Stott, 1892: 8vo, pp. xvi. and 294.

Mr. Rodd's Modern Greece is that of the rural villages where there yet linger traces of ancient ways and thoughts, and where the Europeanising tendency has not yet reached. It is a book of peculiar charm and interest.

Montenegro. *Nouv. Geog.* (1892): 177–181. **Lelarge**

Le Lac de Scutari et la Boiana. G. Lelarge.

Contains a short account of the coast region of Montenegro, with remarks on the best site for establishing a sea-port.

Moravia. *Bul. Soc. Geog. Lyons* **11** (1892): 177–189, 213–230. **Proskowetz.**

La Moravie. Par Max de Proskowetz.

A monograph on the geography of Moravia.

Norway—Norrland. *Norsk. Geog. Selsk. Arbog* **3** (1891–92): 71–86. **Rekstadt.**

Om Svartisen og dens gletschere. Cand. real. J. Rekstadt.

An account of the glaciers of the Svartisen plateau, with a map.

Russia. *Tour du Monde* **64** (1892): 289–362. **Rabot.**

Exploration dans la Russie Boréale (La Petchora, L'Oural, La Sibérie). Par M. Charles Rabot.

A popular and richly illustrated narrative of a journey in Northern Russia undertaken in 1890 by a French scientific mission.

Russian Fauna. *Ausland* **65** (1892): 727–731, 742–745. **Nehring.**

Die geographische Verbreitung der Säugetiere im östlichen Russland und ihre Bedeutung für die mittel-europäische Diluvialfauna. Von A. Nehring (Berlin).

An endeavour to throw light on the mammalian fauna of pre-glacial or inter-glacial Europe by the study of the existing distribution of animals in Russia.

Scandinavia. *Norsk. Geog. Selsk. Arbog* **3** (1891–92): 34–56. **Vogt**

Om istiden under det ved de lange norsk-finske endemoræner markerede stadium. Professor J. H. L. Vogt.

On the action of the ice-sheet in modifying the surface features of Norway, Sweden, and Finland.

Sicily. **Freeman.**

Sicily: Phœnician, Greek, and Roman. By Edward A. Freeman. London, T. Fisher Unwin, 1892: 8vo, pp. xvi. and 378. *Map and illustrations. Price* 5*s.*

This forms Vol. 31 of "The Story of the Nations" Series. In the first chapter Professor Freeman deals with the characteristics of Sicilian history in which he points out how the geographical position of the island has affected its past history. The volume consists of a short history of Sicily from the earliest days of the Greek colonisation down to the time when it was made a Roman province.

ASIA.

Apcheron. *Ausland* **65** (1892): 713–718, 731–734, 745–748. **Stern.**

Ein Besuch an den Naphthaqueller auf Apscheron. Von Bernhard Stern (Wien).

A careful account of all aspects of the mineral oil industry at Baku.

Borneo. **Posewitz.**

Borneo, its Geology and Mineral Resources. By Dr. Theodor Posewitz. Translated from the German, by Frederick H. Hatch, Ph.D. London, Edward Stanford, 1892: Roy. 8vo, pp. xxxii. and 495. *Price* 14*s.*

The German original of this translation was noticed in the *Proceedings* for 1889, p. 512. The present edition is well prepared, and on account of its numerous maps, and the references to Dutch literature, it is the most complete treatise on Borneo in English.

Burma. **MacMahon.**

Far Cathay and Farther India. By Major-General A. Ruxton MacMahon. London, Hurst & Blackett, 1893 [1892]: 8vo, pp. xii. and 340. *Illustrations. Price* 12*s. Presented by the Author.*

The author, who has resided for over twenty-five years in Farther India, has here brought together a collection of notes, supplemented by extracts from articles contributed to various periodicals and mainly relating to Burma. The volume largely deals with the people, including the Burmese, the Talaings and Arakanese, the Shans, the Karens, Chino-Burmese border tribes, and Indo-Burmese border tribes; there are also chapters in which the politics, history and commercial capabilities of the country are somewhat fully discussed.

Caucasus—The Tats. *Bul. Soc. Anthropol. Lyon* **10** (1891): 72–82. **Chantre.**

Les Tats de la vallée inferieure de la Koura. Par Ernest Chantre.

Description of the Tats or Tajiks inhabiting the shores of the Caspian between Derbent and the mouth of the Kura.

Ceylon. *Journ. Roy. Asiat. Soc., Ceylon* **11** (1889): 233–314. **Saar.**

Johann Jacob Saar's Account of Ceylon, 1647–1657. Translated by Ph. Freudenberg.

A quaint and racy account of Ceylon during the contest for supremacy between the Dutch and Portuguese, with many curious details of native life and customs.

China. *Deutsche Rundschau* **15** (1892): 106–113. **Krebs.**

Dürren, Nothstände, Unruhen in China. Ein Beitrag zur Frage der politischen Competenzen der Klimatologie. Von Wilhelm Krebs.

A map showing the areas of drought and of social disturbance in China brings out certain accordances which the author claims to be related as cause and effect.

India—Ganges Delta. *Journ. Asiat. Soc., Bengal* **61** (1892): 109–117. **Wilson.**

Note on the Topography of the River in the 16th century from Hugli to the Sea, as represented in the Da Asia of De Barros. By C. R. Wilson.

Indo-China. *Ann. Geog.* **2** (1892): 97–100. **Guillot.**

La France au Laos. Par E. Guillot.

Account of the origin and spread of French influence on the Upper Mekong.

Oxus. *Ausland* **65** (1892): 705–710. **Komischke.**

Das alte Bett des Oxus. Von W. Komischke.

A summary of the evidence as to the former course of the Amu-darya. See p. 59.

Persia—Demavend. *Verhandl. Gesel. Erdkunde, Berlin* **19** (1892); 304–332. **Hedin.**

Der Demavend nach eigener Beobachtung. Von Sven Hedin.

See *Proceedings*, 1892, p. 565. There are full references to previous climbers.

Persia—Deserts. *Deutsche Rundschau* **15** (1892): 49–59. **Buhse.**

Die grosse persischer Salzwüste und ihre Umgebung. Von Dr. F. Buhse.

This paper is accompanied by a map of the great salt deserts of Persia, showing the routes of Buhse in 1849, Vaughan in 1887, and Christie in 1810.

AFRICA.

African Lakes. *Globus* **62** (1892): 321–325. **Sieger.**

Das gegenwärtige Sinken der grossen afrikanischen Seen. Von Dr. Robert Sieger, Wien.

Summarising the recent observations on the desiccation of the great African lakes, and urging the importance of more systematic observations of water-level than have hitherto been made.

Algiers. **Harris.**

"The" Practical Guide to Algiers. By George W. Harris. Third edition. London, G. Philip & Son, 1893 [1892]: 12mo, pp. xix. and 176, *maps, plan, and illustrations. Presented by the Publishers.*

Egypt—Fayûm. **Brown.**

The Fayûm and Lake Moeris. By Major R. H. Brown, R.E. With a Prefatory Note, by Colonel Sir Colin Scott-Moncrieff, K.C.M.G., C.S.I., and Illustrations from Photographs by the Author. London, E. Stanford, 1892: 4to, pp. vii. and 110. *Price* 10*s.* 6*d. Presented by the Publisher.*

This book will be found reviewed on p. 51.

French Congo. *Bul. Soc. Geog. Comm., Havre*, 1892: 208–231, 257–271. **Blim.**

Le Congo Français. Par E. Blim.

A physical, historical and commercial description of the French Congo Territory.

French West Africa. *Tour du Monde* (1892): 225–288. **Porcher.**

Voyage dans l'Adamaoua, par le lieutenant de vaisseau L. Mizon. Par Harry Alis [H. Porcher].

Numerous illustrations of scenery and natives of Adamawa accompany the text.

German East Africa. *Mitt. Forsch. Deutsch. Shutzgebiete* **5** (1892): 101. **Stuhlmann.**

Aus dem deutsch-ostafrikanischen Schutzgebiete.

Reports of Dr. Stuhlmann's and Father Schynse's journeys between the coast and the Victoria Nyanza, with tables of position, altitude, &c.

German South-West Africa. *Deutsch. Kolonialzeit.* V. (1892): 151–153. **Dove.**

Von Walfischbai nach Otjinbingue. Von Dr. Karl Dove.

Madeira. **Marsh.**

Holiday Wanderings in Madeira. By A. E. W. Marsh. London, Sampson Low & Co., 1892: 8vo, pp. xii. and 180, *illustrations*. *Price* 5*s*. *Presented by the Publishers.*

Nyasaland. *Peterm. Mitt.* **38** (1892): 249–356 (*Map*). **Wichmann.**

Die deutschen Missionsunternehmungen im Njassa-Gebiet. Von H. Wichmann.

Reunion. *Revue Française* **16** (1892): 418–431. **Lacaze.**

Souvenirs Créoles de Bourbon. Par le Docteur H. Lacaze.

Interesting details regarding the more important physical features of Reunion.

Sudan. **Wingate.**

Ten Years' Captivity in the Mahdi's Camp, 1882–1892. From the original manuscripts of Father Joseph Ohrwalder, late Priest of the Austrian Mission Station at Delen in Kordofan. By Major F. R. Wingate, R.A. With maps and illustrations, by Walter C. Horsley. London, Sampson Low, Marston & Co., 1892: 8vo, pp. xv. and 460. *Price* 21*s*. *Presented by the Publishers.*

This is a thrilling narrative of events in the Mahdi's camp during the period of his greatest success, and a record of the subsequent decay of the Mahdist power under the reckless government of the Khalifas. Father Ohrwalder and two sisters of the Austrian Mission survived their imprisonment for ten years, and were at length rescued by an Arab guide sent across the desert from Egypt. The book throws great light on the character of the Baggaras, the tribe of river Arabs who formed the nucleus of the Mahdi's hosts.

Uganda. **Foster.**

Uganda. Notes on the Geography, Government and Inhabitants of Uganda, with a sketch of its history to 1892. By Captain Hubert Foster. Fo. pp. 7. Prepared in the Intelligence Division of the War Office, September 1892. *Presented by the Intelligence Division.*

Uganda. **Smith.**

Uganda. Two Letters to 'The Times.' By R. Bosworth Smith. London, &c., Cassell & Co., 1892: 8vo, pp. 16. *Price* 2*d*. *Presented by the Author.*

Windhoek. *Deutsch. Kolonialblatt* **3** (1892): 523. ——

Ueber die Ansiedelungen in Windhoek.

Brief notice, with large scale map, of the new German settlement of Windhoek, inland from Walfisch Bay.

Zambezia. *Scot. Geog. Mag.* **8** (1892): 569–579. **Rankin.**

Explorations in the Loangwa-Zambesi Basin. By Daniel J. Rankin.

NORTH AMERICA.

Canada—Cape Breton. *Trans. Roy. Soc. Canada*, 1891, *Sect.* II.: 173–343. **Bourinot.**

Cape Breton and its memorials of the French Régime. By J. G. Bourinot.

A comprehensive account of the history and historical geography of Cape Breton Island (Ile Royale). With maps.

Chicago. ——

Rand, McNally & Co.'s Handy Guide to Chicago and World's Columbian Exposition. Chicago and New York, Rand, McNally & Co., 1892: 12mo, pp. 219, *illustrations*. *Presented by the Publishers.*

This little volume has been prepared for the use of visitors to Chicago, and to its forthcoming exhibition. It describes the various sights of the city, and contains chapters on its educational and other institutions, art and architecture, monuments,

etc., with a special chapter on the World's Columbian Exposition. An excellent plan of Chicago is given at the end of the volume.

Newfoundland—Beothiks. *Trans. Roy. Soc. Canada*, 1891, *Sect.* II.: 123. **Patterson.**

The Beothiks or Red Indians of Newfoundland. By the Rev. George Patterson, D.D.

The Beothiks became extinct in 1829, and Dr. Patterson has in this memoir put together all the references to the race which appeared likely to be serviceable in giving a correct description of them. In many respects they seem to have been more gentle and intelligent than the other Red Indian races.

Canada—Shuswaps. **Dawson.**

Notes on the Shuswap People of British Columbia. By George M. Dawson, LL.D., F.R.S. *Reprint from Trans. Roy. Soc. Canada*, 1891: 4to, pp. 44 (*Map*).

Santo Domingo. *Bul. Soc. normande de Géog.*, 1892: 168–188. **Breard.**

Notes sur St.-Domingue tirées des papiers d'un armateur du Havre (1780–1802). Par M. Ch. Bréard.

Interesting notes on the period preceding the formation of the Republic of Haiti.

United States and Canada. **Appleton.**

Appleton's General Guide to the United States and Canada. Illustrated. With Railway Maps, Plans of Cities, and Table of Railway and Steamboat Fares. Edinburgh, A. and C. Black, 1892: 12mo, pp. xvi. and 602. *Price* 10*s.* 6*d.*

This work covers a very wide area. Among the new features of the present edition may be mentioned:—Descriptions of routes, resulting from increased railroad facilities; descriptions of resorts, notably those on the Pacific Coast; the latest information concerning each of the leading cities, by some special expert; itineraries of each of the larger cities; new plans, maps, and illustrations.

SOUTH AMERICA.

Amazons. *Revist. Soc. Geog. Rio de Janeiro* (1891): 161–179. **Tapajoz.**

As correntes do Amazonas e o phenomeno da Pororoca. Dr. Torquato Tapajoz.

Description of the currents of the Amazons, and examination of the opinions and observations of Buffon, Condamine, Bumsel, Humboldt, Lartigue, Maw, Tardy de Montiavell, Ennes de Sousa, Baron do Ladario, and Aguiar Lima, on the tidal floods of the Ganges (*Bore*), Seine (*Mascaret*), Gironde, Thames, and Severn, with special application to the *Pororoca* of the Amazons and other rivers of the north-east coast of Brazil and Guiana, with some legends connected therewith.

Amazons. *Bol. Soc. Geog. Madrid* **33** (1892): 24–79. **Espada.**

Noticias autenticas del famoso rio Maranon, por D. Marcos Jimenez de la Espada.

The last part of a long series of articles summarising the early documents regarding the discovery and exploration of the Amazons.

Amazons Tribes. *Globus* **62** (1892): 1, 33, 70, 100, 133, 181, 214, 259, 326. **Ehrenreich.**

Südamerikanische Stromfahrten. Von Dr. Paul Ehrenreich, Berlin.

American History. **Payne.**

History of the New World called America. By Edward John Payne. Vol. I. Oxford: Clarendon Press, 1892: Roy. 8vo, pp. xxviii. and 546. *Price* 18*s.* *Presented by the Delegates of the Clarendon Press.*

This volume treats in a scholarly and philosophical manner of the early history of America, including its discovery by the Northmen and by Columbus. Fully half the work is devoted to an account of the primitive social conditions of American nations. In this much new light is thrown on the relation between land and people

in Mexico and Peru, the author bringing to bear on the problem the new theory that in primitive peoples advancement has "no loftier origin than the organised provision of the food supply on an artificial as distinguished from a natural basis."

Andes. **Hettner.**

Die Kordillere von Bogotá. Von Dr. Alfred Hettner. Gotha, Justus Perthes, 1892. Imp. 8vo, pp. 131, *maps and illustrations. Price* 6 *marks.*

This work on the Andes of Bogota is Ergänzungsheft No. 104 of *Petermann's Mitteilungen*. See *Proceedings*, 1892, p. 850.

Argentina. *Bol. Inst. Geog., Argentino* **13** (1892): 168–180. **Ambrosetti.**

Rapida ojeada sobre el territorio de Misiones. Por Juan B. Ambrosetti.

Detailed description of the territory of Misiones at present under dispute between the Argentine Republic and Brazil.

Brazil. *Revist. Soc. Geog. Rio de Janeiro* (1891): 81–91. **Villeroy.**

Aponta mentos sobre a Linguagem dos Indios Coroado-Bororó.

A grammatical classification of vocabularies of the languages spoken by the Bororó Indians in Mattogrosso and Goyaz (Brazil), collected during the exploration of the Paranatinga River.

Chile. *Notes de la Société Scientifique du Chile, Santiago*, 1892: xlii.–xliv. **Nogues.**

Moraines et Glaciers de la Cordillère de Chillan.

Discovery. *Zeits. Gesells. für Erdkunde, Berlin* **27** (1892): 153. **Gelcich.**

Zur geschichte der Entdeckung Amerikas durch die Skandinavier. Von Eugen Gelcich.

A full account of the part played by the Northmen in discovering the American continent, and an enquiry into the probability of the reports of this discovery determining the voyage of Columbus.

Historical. *Ann. Geog.* **2** (1892): 65–91. **Gallois.**

Etat de nos connaissances sur l'Amerique du sud. Par L. Gallois, professeur de Lyon.

A useful summary with copious references.

Honduras, British. **Bristowe.**

The Handbook of British Honduras for 1892–93, comprising historical, statistical, and general information concerning the Colony. By Lindsay W. Bristowe. Edinburgh and London, W. Blackwood and Sons, 1892: large 8vo. pp. xii. and 275, *map.*

Paraguay. **Bourgade la Dardye.**

Paraguay: the Land and the People, Natural Wealth and Commercial Capabilities. By Dr. E. de Bourgade la Dardye. London, G. Philip & Son, 1892: cr. 8vo, pp. xiii. and 243. *Map and illustrations. Price* 7*s.* 6*d. Presented by the Publishers.*

The original edition of this work was published in 1889, and noticed in the *Proceedings* for 1890, p. 642. The present translation has been edited by Mr. E. G. Ravenstein.

AUSTRALIA AND PACIFIC ISLANDS.

Kei Islands. *Globus* **62** (1892): 314–316. *With map.* **Planten.**

Planten's Erforschung der Key-Inseln.

Results of the exploration of this group in the Banda Sea by Lieutenant Planten of the Dutch navy in 1889–90. They are coral islands, producing iron-wood, sago, maize, and coconuts, and have a population of about 23,000.

Magnetic Shoal. *Proc. Roy. Soc. Victoria* **4** (1892): 65–68. **Ellery.**

The Magnetic Shoal near Bezout Island, off Cossack, North-west Coast of Australia. By R. L. J. Ellery.

Brief report of the submarine bank in 20° 32′ 35″ S. and 117° 13′ 2″ E., where a deflection of the compass of 56° was observed.

New Guinea. **Thomson.**

British New Guinea. By J. P. Thomson. London, George Philip & Son, 1892: Roy. 8vo, pp. xviii. and 336. *With map.* *Price* 21*s.* *Presented by the Author.*

A brief historical sketch is followed by a somewhat detailed account of recent exploration in British New Guinea, principally the work of Sir William MacGregor. Appendices are given by various specialists on the geology, flora, insects, reptiles, and languages, of New Guinea. There are several illustrations.

Polynesian Languages. **Macdonald.**

South Sea Languages A Series of Studies on the Languages of the New Hebrides, and other South Sea Islands. By the Rev. D. Macdonald. 2 vols. Melbourne, 1889–1891: 12mo, pp. 134.

Vol. I. contains Studies on the Languages of Efate, Eromanga, and Santo. Vol II. contains Introductory Comparative Notes, and Studies on the Languages of Tangoan—Santo, Malo, Malekula, Epi (Baki and Bierian), Tauna and Futuna.

Travels. **Baden-Powell.**

In Savage Isles and Settled Lands, Malaysia, Australasia, and Polynesia, 1888–1891. By B. F. S. Baden-Powell. London, Richard Bentley & Sons, 1892: 8vo, pp. x. and 438. *Map and illustrations.* *Price* 21*s.*

A pleasantly written record of passing visits to the Australian Colonies, New Guinea, Batavia, Sarawak, Samoa, and a trip round the world. The remarks on places and people are always good-humoured and kindly, although of course there is little in them that is new.

Voyage. **Dewar.**

Voyage of the *Nyanza*, R.N.Y.C. Being the record of a three-years' cruise in a schooner-yacht in the Atlantic and Pacific, and her subsequent shipwreck. By J. Cumming Dewar. Edinburgh, William Blackwood & Sons, 1892: 8vo, pp. xviii. and 466. *Map and illustrations.* *Price* 21*s.* *Presented by the Publishers.*

The *Nyanza* sailed from Plymouth Sound on July 21st, 1887, visited Fernando Noronha and other islands, passed through Magellan's Strait, coasted along South America to Callao, crossed the Pacific, calling at Easter Island, to New Caledonia; then by the Sandwich Islands to San Francisco and Vancouver, thence to Japan and Kamchatka, and south again to Panapi, where she was wrecked on a coral reef on July 29th, 1890.

POLAR REGIONS.

Greenland. **Nansen and Mohn.**

Wissenschaftliche Ergebnisse. Von Dr. F. Nansens Durchquerung von Grönland, 1888. Gotha, Justus Perthes, 1892. *Imp.* 8vo, *pp.* 112.

Ergänzungsheft, No. 105 of *Petermann's Mitteilungen.* Part I. is occupied by a discussion of the astronomical, mathematical, trigonometrical, and meteorological observations by Professor Mohn. Part II., by Dr. Nansen, gives a full discussion of the geological and hydrographical work. There are appendices on the mud from the coast ice by Dr. Törnebohm, and on the carbonic acid in the air by Dr. Otto Petterson. The memoir is fully illustrated by maps and diagrams.

Jan Mayen. *Norsk. Geog. Selsk. Arbog.* **3** (1891–92): 57–70. **Mohn.**

Øen Jan Mayen. Professor H. Mohn.

An account of Jan Mayen, illustrated by seven full-page views of the island and four maps.

Spitzbergen. *Comptes Rendus* **115** (1892): 683–687. **Bienaimé.**

Résumé succinct des resultats du voyage du transport-aviso la Manche en Islande, à Jan Mayen et au Spitzberg pendant l'été de 1892. Par le Capitaine Bienaimé.

An epitome by the commander of the expedition of the scientific results ascertained in Jan Mayen and Spitzbergen by Professor Pouchet, M. Rabot, and others. The work comprises exploration, study of glaciers, tides, magnetic conditions, the value of *g*, and natural history collections.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Continental Outlines. *Science* **20** (1892): 282–284. **Parker**

Origin of the Lines of Mars. By Professor Henry W. Parker.

A comparison of the maps of Mars and the Earth resulting in the opinion that in both cases the form of the main continental lines was due to the action of lunar and solar tides in the viscous spheroid.

Estuaries. *Revue Géog.* **16** (1892): 345–354. **Girard.**

Charactères des estuaires. Par M. J. Girard.

This instalment of M. Girard's geography of the sea margin is defective in taking account neither of Osborne-Reynolds' valuable experimental work on estuaries, nor of the fairly complete physical surveys which have been made on the estuary of the Forth and the Clyde Sea Area and to some extent on the Thames.

Geodesy. *Compt. Rend.* **115** (1892): 706–708. **Bassot.**

Sur la nouvelle Meridienne de France.

A preliminary note on the conclusion of the re-measurement of the arc of the meridian, commenced in 1870. See note, p. 71.

Geodesy. *Journ. Franklin Inst.* **134** (1892): 358–366. **Gore.**

How the Earth is Measured. By Prof. J. Howard Gore.

A popular exposition of the principles of Geodesy.

Geodesy. *Cosmos* **11** (1892): 20–27, 50–63, 105–121. **Mallino.**

Il valore metrico del Grado di Meridiano secondo i geografi Arabi. C. A. Mallino.

A laborious and apparently exhaustive enquiry into the length of a degree of the meridian as estimated by the early Arabian geographers.

Maps. *Bol. Soc. Geog. Italiana* **5** (1892): 681—740. **Botto.**

Progressi fatti negli ultime tempi dalla Cartografia nei vari Stati di Europa e più specialmente in Italia. Relazione del ten. colonnello del genio A. Botto.

An account of the principal official maps produced by the Governments of the following European countries:—Austria-Hungary, Belgium, Denmark, France, Germany, Great Britain, Italy (in great detail), Holland, Portugal, Rumania, Russia, Spain, Sweden and Norway, Switzerland.

Photo-topography. *Bol. Soc. Geog. Italiana* **5** (1892): 658–675. **Paganini.**

Del rilevamento fototopografico. Relazione dell' ingegnere P. Paganini.

On the use of photography in surveying and mapping as applied in Italy.

GENERAL.

Bow and Arrow. *Ausland* **65**: 689–694. **Schmeltz.**

Ueber Bogen von Afrika und Neu-Guinea. Von J. D. E. Schmeltz.

An ethnographical article, discussing the use of the bow and arrow amongst the natives of Africa and New Guinea.

Columbus. **B. A. V.**

Qui a imprimé la première lettre de Christoph Colomb. [B. A. V.] Extrait du 'Centralblatt für Bibliothekswesen,' 1892, III. Leipzig, Otto Harrassowitz, 1892: 8vo, pp. 20. *Presented by the Author.*

Columbus. **Chagas.**

Os Descobrimentos Portuguezes e os de Colombo. Tentativo de Coordenação Historica. Por Manuel Pinheiro Chagas, Secretario Geral da Academia Real das Sciencias de Lisboa. Lisboa, 1892: 8vo, pp. 244. *Presented by Mr. Batalha Reis.*

Columbus. **Duquesa de Berwick y de Alba.**

Autografos de Cristobal Colon y Papeles de America. Los publica La Duquesa de Berwick y de Alba, Condesa di Siruela. Madrid, 1892: Fol. pp. v. and 203. *With facsimile autograph letters. Price* 14*s.*

Columbus. **Elton.**

The Career of Columbus. By Charles J. Elton, F.S.A. London, Cassell & Co., 1892: 8vo, pp. xii. and 307. *Price* 10*s.* 6*d.* *Presented by the Publishers.*

Columbus. **Lazzaroni.**

Cristoforo Colombo. Osservazioni critiche sui punti più rilevanti e controversi della sua vita. Pubblicate per cura di M. A Lazzaroni Con disegni di Leramo Rossi Scotti e figure di Cose e Monumenti Colombiani. Milano, Fratelli Treves, 1892: 4to, 2 *vols.*, pp. 446 and 392. *Price* 14*s.*

Columbus. **Lollis.**

Cristoforo Colombo nella Leggenda e nella Storia. Di Cesare De Lollis. Milano, Fratelli Treves, 1892: 8vo, pp. 377. *Presented by the Italian Geographical Society.*

Columbus. **Markham.**

Life of Christopher Columbus. By Clements R. Markham, C.B. (The World's Great Explorers and Explorations Series). London, G. Philip & Son, 1892: 8vo, pp. 375. *Price* 4*s.* 6*d.* *Presented by the Publishers.*

The foregoing and other volumes called forth by the Columbus celebrations in various countries will form the subject of a special review.

Columbus. *Verhand. Gesell. Erdkunde Berlin* **19** (1892): 401–421. **Kretschmer.**

Christoph Columbus als Kosmograph. Von Herr Dr. Konrad Kretschmer.

An important contribution to the literature of the Columbus centenary.

Columbus. *Bol. Soc. Geog. Madrid* **33** (1892): 7–23. **Neussel.**

Investigaciones que demuestran que la isla Vatlin es la isla Guanahani, llamada por Christobal Colon San Salvador, y que fué la isla primera que descubrio y visito el gran navegante, por Otto Neussel.

Proofs as to the identity of Watling Island with Columbus' landfall. With map of the voyages of Columbus.

Columbus. *Deutsche Rundschau* **15** (1892): 1–9, 71–79. **Ruge.**

Die Familie des Columbus. Von Dr. Sophus Ruge.

Desert Life. *Oest. Monats. für Orient.* **18** (1892): 97–103, 109–117. **Josaphat.**

Wüste und Wüstenvolk. Von Don Josaphat.

Characteristics of the wandering Arab tribes.

Diogo Cão. *Bol. Soc. Geog. Lisboa* 11A *Ser.* (1892): 90–155. **Cordeiro.**

Descobertas e Descobridores. Diogo Cão. By Luciano Cordeiro.

Biographical notice of the early African explorer, with illustrations showing the pillars erected by him on the Coast of Africa.

History of Discovery. *Deutsch. Geog. Blätt.* **15** (1892): 214–234. **Gelcich.**

Die Bedeutung Dieppes im Zeitalter der grossen Länder-Entdeckungen. Von Eugen Gelcich.

Narrative of the part taken by Dieppe sailors in geographical discovery during the fifteenth and the beginning of the sixteenth centuries.

Maps. *Zeits. Gesell. Erdkunde, Berlin* **27** (1892): 221–247. **Bludau.**

Flächentreue Gradnetz-Projektionen für die Karten von Süd- und Nord-Amerika und Australien. Von Dr. Alois Bludau.

Full details with tables of coordinates and outline maps for the construction of maps on an equivalent area gnomonic projection.

Mediterranean Health Resorts. **Ball.**

Mediterranean Winter Resorts; a practical Handbook to the principal Health and Pleasure Resorts on the shores of the Mediterranean. . . . Edited by E. A. Reynolds Ball. Second edition. London, E. Stanford, 1892: 12mo, pp. xiv. and 336. *Map and illustrations. Presented by the Publisher.*

In the present edition, which has been enlarged, several new and important features have been introduced. Greater prominence has been given to the medical aspect of the principal invalid resorts, and special articles dealing with the climatic, sanitary, and general hygienic conditions of these places, have been contributed by resident English physicians. Another new feature is the introduction of detailed descriptions of the newer health resorts, such as Biskra, Luxor, Helwan in North Africa; St. Raphael, Grasse, Beaulieu, Ospedaletti on the Riviera; and Torre del Greco, Castellamare, and Amalfi on the South Italian Littoral.

Mountains. *Bul. Soc. Anthropol. Paris* **3** (1892): 221–237. **Regnault.**

Du rôle des montagnes dans la distribution des races. Par Felix Regnault.

Discussion of the effect of mountain ranges on the distribution of races.

Obituary. *Ausland* **65** (1892): 753–754. **Höfler.**

Friedrich von Hellwald. Von M. Höfler (Tölz.).

Brief biographical notice, with list of works. A notice with portrait also appears in *Globus* **62** (1892): 349–350.

Obituary. *Ausland* **65**: 721–723. **Wolkenhauer.**

Arthur Breusing. Von W. Wolkenhauer (Bremen).

A summary of the work of this distinguished cartographer.

Sport. **Buxton.**

Short Stalks; or, Hunting Camps, North, South, East and West. By Edward North Buxton. London: Edward Stanford, 1892: 8vo, pp. xiii. and 405. *Numerous illustrations. Price* 21*s. Presented by the Publishers.*

Mr. Buxton has illustrated his book with a set of highly-finished wood-engravings which make the scenes of his hunting-camps very vivid to the reader. His range is wide, including mountain-hunting in the Alps, Pyrenees, and Rocky

Mountains, trips into the Sahara on the South, and the northern plain of Scandinavia. Nothing could be better of its kind than his descriptions of scenes and characters. The work is of high literary merit.

Time-reckoning. **Lullin.**

Institution d'un Méridien Central Unique et d'une heure universelle avec maintien de l'heure locale. Par E. I. Lullin, Ingenieur. *Geneve, Imprimerie Suisse*, 1892: 8vo, pp. 40. *With two maps.*

Toscanelli. **Uzielli.**

Paolo dal Pozzo Toscanelli, Iniziatore della Scoperta d'America. Ricordo del Solstizio d'Estate del 1892. Firenze, Loescher & Seeber, 1892: 8vo, pp. 247. *Presented by the Author*

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

Germany. **Langhans.**

Die Reste des Frisischen Sprachgebiets im Deutschen Reich, Nach den neuesten Forschungen entworfen u. gezeichnet von Paul Langhans. Scales 1:200,000 (or 2·7 geographical miles to an inch); and 1:400,000 (or 5·5 geographical miles to an inch). *Petermann's Geographische Mitteilungen*, Jahrgang, 1892. Tafel 20. Justus Perthes, Gotha, 1892. *Presented by the Publisher.*

Great Britain. **Ordnance Survey.**

Publications issued since November 15th, 1892.

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Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 40, Parts of Districts Ratnagherri, Sholapoor and Satara and Kalapoor Native State (Bombay Presidency). 74, Parts of Districts Yelgandel, Indur, Medak, Sirpur, Tandur, and Khammamet (Nizam's Dominions), District Chanda and Native State Bastar (Central Provinces). Quarter Sheets: 105, S.E. Parts of Lohar-

dugga, Gangpur Bonai, and Singhbhoom (Chola Nagpore of Jaipur and Bamra (Central Provinces), and of Keonjhar (Orissa). 115, Parts of Districts Balasore, Cuttack and Midnapore, and of Mayurbhanja, Keonjhar, Dhenkanal Hindol, Bonai Lahara, Tigiria and Baramba Tributary States of Orissa (Bengal). 130, S.E. Parts of District Naga Hills, Manipur Native State and of Naga Tribes (Assam).—Eastern Bengal, 8 miles to an inch. Sheet No. 14, Hooghly, Howrah. 24, Pergunnahs, Khoolna, Bachergunge, Noakholly, and Sundarbans. Sheet No. 15, containing Parts of Districts Tipperah, Noakholly, Chittagong, Chittagong Hill Tracts, and Native State Hill Tipperah.—Madras Survey, 1 inch to a mile: No. 151, Part of District Madura. Seasons 1879–88.—Central Provinces Survey, 1 inch to a mile. Seasons 1864–66 and 1869–70. Sheet No. 82, Parts of District Damah (Central Provinces), and of Panna, Ajaigarl, and Bijawar States (Central India Agency). Seasons 1864–66 and 1869–70.—Madras Survey, 1 inch to a mile. Sheet No. 151, Part of District Madura. Seasons 1879–88.—Bombay Survey, 1 inch to a mile. Sheet No. 185, Parts of Baroda, Rewa Kantha Agency, and Khandesh District. Season 1889–90. No. 255, Parts of Districts Kandesh and Nisik. Seasons 1874–76 and 1878–81.—North-west Provinces and Oudh Survey, 1 inch to a mile. Sheet No. 176 (Preliminary Edition), District Basti (with Overlap of District Fryzabad. Seasons 1884–86.—Bengal Survey, 1 inch to a mile. Sheet No. 5, Parts of Rewah Native State (Central India Agency), and of Porea Tributary State, Chola Nagpore (Bengal). Seasons 1868–69 and 1871–72. No. 363, Districts Mymemsingh and Dacca. Seasons 1850 to 1854 and 1857–58.—Bengal Survey (District 24 Purgunnatis). Sheet No. 5, additions of Railway, 1892.—Bengal Survey (Districts Hooghly and Howrah), 1869–73, 1 inch to a mile. Sheets Nos. 1, 2, 3, 4, 5, corrections to 1892.—Punjab Survey, 1 inch to a mile. Sheet No. 247, Districts Hoshiarpur and Gurdaspur. Seasons 1886 to 1888. No. 316, Districts Umballa Karnal and Saharanpur. Seasons 1 70–72, 1878–80, 1887–88. —Lower Burma Survey, 1 inch to a mile. Sheet No. 569, District Nergui. Season 1890–91.—North Eastern Frontier, 1 inch to 4 miles. Sheet No. 23, S.W. (5th edition). Parts of Districts Bhams and Katha (Upper Burma). Seasons 1887–88–89–90.—North Eastern Frontier, 1 inch to 8 miles. Sheet No. 22 (3rd edition), Parts of Assam and of Singpho Hills. 1892.—South Eastern Frontier, 1 inch to 4 miles. Seasons 1885 to 1891. 1 N.E. (4th edition), Parts of Districts Upper Chindwin, Yeu, Katha, and Shwebo, of Wuntho Shan State (Upper Burma), and of Manipur Native State Assam. 1 S.E. (5th edition), Parts of Upper and Lower Chindwin, Pakokku, Ye-w, Shwebo, Mandalay, and Sagaing Districts (Upper Burma). 2 S.E. (4th edition), Parts of Districts Pakokku, Minbu, Myingyau, Meiktila, Yaneethin, Magwe, and Pyinmana (Upper Burma), 3 N E. (3rd edition), Parts of Districts Minbu, Magwe, and Pyinmana (Upper Burma), and Thayetmyo, Prome, and Tonngoo (Lower Burma). 4 S.E. (3rd edition), Parts of the Shan States (Upper Burma).—South-eastern Frontier, 1 inch to 8 miles. No. 1 (3rd edition), Parts of the Lushai and Chin Hills, of Wuntho (Shan State), and the Districts of Upper and Lower Chindwin, Katha, Shwebo, Yeu, Pakokku, Sagaing, and Mandalay (Upper Burma); of Northern Arakau (Lower Burma); of the District and Hill Tracts of Chittagong, and of Hill Tipperah (Bengal).—Upper Burma, 1 inch to 64 miles, corrections to March, 1892.—Gurjat States, Tributary States of Chota Nagpur, 1 inch to 16 miles. 1892.—Bombay Presidency, 1 inch to 80 miles, corrections to 1891.—Central India Agency, 1 inch to 80 miles, corrections to 1891. Rajputana Agency, 1 inch to 80 miles, corrections to 1891.—District Gya, Bengal, 9½ miles to an inch. 1890.—District Jalaun, N.W. Provinces and Oudh, 1 inch to 8 miles. 1891.—District Burdwan, Bengal, 1 inch to 8 miles, 1890.—District Pubna, Bengal, 1 inch to 8 miles. 1890.—District Jalpaiguri, Bengal, 1 inch to 8 miles. 1890.—Shahabad, Lower Provinces, Behar.—Bengal, 1 inch to 4 miles, corrections to December, 1891.—District Patna, Lower Provinces, Bengal, 1 inch to 4 miles, corrections to July, 1891.—Ulwar State, Rajputana, 4 miles to an inch, corrections to April, 1892.—Ganjam and Orissa, Topographical Survey, 4 miles to an inch. Portions of Raipur, Bilaspur, &c. (Triangulation Sheet). Season 1863–64.—North-east Longitudinal Series, 1 inch to 4 miles. Charts Nos. 2, 5, and 6 (Triangulation Sheets). *Presented by H.M. Secretary of State for India, through India Office.*

AFRICA.

Africa. **Habenicht.**

Special-Karte von Afrika, im Massstab von 1:4,000,000 (or 55·5 geographical miles to an inch). Entworfen von Hermann Habenicht, bearbeitet von demselben, Bruno Domann und Dr. Richard Lüddecke. Dritte Auflage; V. Lieferung. Inhalt: Sektion West Sudan (4) nebst Bemerkungen von B. Domann. Sektion Seengebiet (8) nebst Bemerkungen von Dr. R. Lüddecke. Supplement-Lieferung. Inhalt: 1. Ethnographische Übersicht von Afrika, 2. Höhen-und Tiefen-Übersicht von Afrika. Gotha, Justus Perthes, 1892. *Price 3s. each part.* (*Dulau.*)

Part No. 5 contains Section 4, West Sudan; and Section 8, the Lake Region. In the supplementary part an ethnographical map of Africa, and a map showing the elevations of the land and depths of the ocean are given. The present edition of this valuable map is now complete.

Africa. **Herrich.**

Carl Flemmings Generalkarten No. 43, Afrika. Entworfen von A. Herrich. Scale 14,500,000 or 198·6 geographical miles to an inch. Druck und Verlag von Carl Flemming in Glogau. *Price 1s.*

This is a new edition of Flemming's well-known general map of Africa, corrected and brought up to date.

Central Africa. **Stuhlmann and Emin Pasha.**

Übersichtskarte der Reisen von Dr. F. Stuhlmann mit Emin Pascha, 1890–1892. Scale 1:4,000,000 or 55·5 geographical miles to an inch. Gesellschaft für Erdkunde zu Berlin. Sitzung vom 5. November 1892. *Presented by the Berlin Geographical Society.*

Central Africa. **Dybowski.**

Itinéraire dans l'Afrique Centrale du Loango au Chari, 1891–92. Jean Dybowski. Scale 1:1,500,000 or 20·4 geographical miles to an inch. Publié par les soins de la Société de Géographie de Paris. *Presented by the Paris Geographical Society.*

Lake Region. **Merensky.**

Karte der Berliner-Missions—Expedition im Norden des Nyassa. Entworfen von A. Merensky, mit Zusätzen von Dr. B. Hassenstein. Scale 1: 600,000, or 8·2 geographical miles to an inch. *Petermann's Geographische Mitteilungen.* Jahrgang, 1892, Tafel 19. Gotha: Justus Perthes, 1892. *Presented by the Publisher.*

Orange Free State. **Herfst.**

Officieele Kaart van den Oranje Vrijstaat, samengesteld naar documenten berustende in het Archief van den Landmeter Generaal door J. J. Herfst, met Toestemming opgedragen aan Z. H. Ed. den Staatspresident. Bloemfontein, November, 1891. Bygewerkt volgens de besluiten van den H. Ed. Volksraad dd. 7, 9, 11, Mei 1892. Scale 1:1,500,000, or 20·4 geographical miles to an inch. Deale Brothers, booksellers and stationers, Bloemfontein, O.F.S. *Price 7s. 6d. Stanford.*

Though this is a poor specimen of cartography, it is nevertheless important, as so very few maps of the Orange Free State are obtainable in this country. Some statistics with reference to the population are given, all means of communication are clearly laid down; but there is no explanation with regard to the colouring.

AMERICA.

Colombia. **Hettner.**

Die Kordillere von Bogotá, Von Dr. Alfred Hettner. I., Geologische Ubersicht. II., Höhenschichten. III., Pflanzendecke. IV., Ortschaften u. Volksdichte. Scale 1:1,600,000, or 21·9 geographical miles to an inch. —— Geologische Profile durch die Kordillere von Bogotá, Entworfen and Gezeichnet von Dr. A. Hettner. *Petermann's Geographische Mitteilungen,* Ergänzungsheft No. 104. Tafel 1 & 2. Gotha, Justus Perthes, 1892. *Presented by the Publisher.*

Costa Rica. **Peralta.**

Mapa Histórico-Geográfico de Costa Rica y del Ducado de Veragua por D. Manuel M. de Peralta, Madrid, 1892. Scale 1 : 1,000,000, or 13·6 geographical miles to an inch. Edición especial para el IV.° Centenario del Descubrimiento de América. Bruselas. Instituto Nacional de Geografia. *Presented by the Legacion de la Republica de Costa Rica, Madrid.*

Greenland. **Nansen.**

Karte von Süd-Grönland zur übersicht der Norwegischen Expedition, 1888. (Scale 1 : 4,000,000, or 55·5 geographical miles to an inch.)—Schnitt durch Grönland am 64 Breitengrade. Dr. Nansens Route durch Grönland. Nunataken auf der Nordseite der Reiseronte. Auf Station 6 (22 August) durch die Camera clara gezeichnet.—Die Temperatur der Luft auf dem Grönlandeise. Tägliche Periode der Luft—Temperatur.—Die bekannten Profile des Inlandeises. Zusammengestellt von Dr. Andr. M. Hansen. *Petermann's Geographische Mitteilungen.* Ergänzungsheft, No. 105. Gotha : Justus Perthes, 1892. *Presented by the Publisher.*

OCEANS.

Atlantic Ocean. **U. S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean. November, 1892. With supplement containing charts and text descriptive of the hurricane of Nov. 21–28, off the Atlantic Coast of the United States. Published at the Hydrographic Office, Bureau of Navigation, Navy Department, Washington D.C. Richardson Clover, Lieut.-Commander U.S. Navy, Hydrographer.

GENERAL.

Astronomy. **Ball.**

An Atlas of Astronomy. A Series of Seventy-two Plates. With Introduction and Index. By Sir Robert Stawell Ball, LL.D., F.R.S. London, George Philip & Son, 1892 : *Price* 15*s*. *Presented by the Publishers.*

This atlas contains seventy-two plates with an introduction, in which ample information is given with regard to the methods of using them. There are various novel features in the atlas which are worthy of special attention, the first of which is a series of sun-spot charts. These have been drawn on the principle employed by Mr. Arthur Thomson; and with their aid the heliographic latitude and longitude of a sun-spot may be determined within a single degree. Another feature is the "Index to Planets," which will be of great service to the beginner in the identification of these bodies. The series of moon-charts contain careful representations of the lunar formations, and give pictures of the moon for nearly every age, at which it can be satisfactorily observed, up to the time of the full. Each of these pictures is furnished with a key and index of names. This atlas also contains drawings of Jupiter, Saturn, a map of the Pleiades, a chart of Mars, plates representing nebulæ, comets, star charts, and indeed all the maps and diagrams requisite to make it a complete atlas of astronomy. The letterpress is written in the author's usual clear style, and concludes with a well-chosen selection of telescopic objects.

Discovery of America. **Kretschmer.**

Atlas der Festschrift der Gesellschaft für Erdkunde zu Berlin zur Vierhundertjährigen Feier der Entdeckung Amerika's. Berlin, 1892. (With text). *Presented by the Berlin Geographical Society.*

German Colonies. **Langhans.**

Deutscher Kolonial-Atlas. Dreissig Karten mit vielen Hundert Nebenkarten entworfen, bearbeitet und herausgegeben von Paul Langhans. Erste Lieferung. Inhalt : Vorwort und Inhaltsübersicht. No. 1, Verbreitung der Deutschen über die Erde. No. 25, Schutzgebiet der Neu Guinea-Kompanie, Blatt 2. Gotha, Justus Perthes, 1893. *Price* 2*s*. *each part.* (*Dulau.*)

This is the first issue of what promises to be a very good atlas of the German Colonies. It will be completed in fifteen parts, which will be issued at intervals of from

four to six weeks, each to contain two maps. The present issue contains a preface an index to the whole work, and maps Nos. 1 and 25. The former gives the distribution of Germans throughout the world, and the latter forms part of a six-sheet map, the possessions of the German New Guinea Company. The maps are very well drawn, and numerous insets are given.

The World. **Baur.**

Neueste Karte der Erde. Mit Rücksicht auf das Bedürfniss des Handelstandes sowie für den Unterricht an Lehr-Anstalten, entworfen und gezeichnet von C. F. Baur. Verlag von Julius Maier. Separat-Konto, Fr. Doerr in Stuttgart. *Price* 6*s*. *Williams and Norgate.*

The World. **Cassell.**

The Universal Atlas. Complete in 28 parts, including Index. Published by Cassell & Co., Limited, London, for the Atlas Publishing Company, Limited. Part 21. *Price* 1*s*. *each part*. *Presented by the Publishers.*

This part contains maps of South India, Burma and Malay Peninsula, a general map of Africa, and the first part of the index.

Historical Geography. **Vidal-Lablache.**

Histoire et Géographie. 137 Cartes, 248 Cartons. Atlas Vidal-Lablache, Maitre de Conférences de Géographie a l'École Normale Supérieure. Paris: Armand Colin et Cie., Editeurs. 17e Livraison. *Price* 1*s*. 2*d*. *Dulau.*

Three historical and three geographical maps are contained in this number, and, as usual with this atlas, numerous insets and copious foot-notes are given.

PHOTOGRAPHS.

West Africa. **Lang.**

Twenty-three Photographs of Scenery and Natives of West Africa, in the neighbourhood of Kumassi, Bontuku, &c., taken by Capt. J. I. Lang, R.E. *Presented by Capt. J. I. Lang, R.E.*

This is a very interesting series of photographs taken by Capt. J. I. Lang, R.E., while travelling and serving on the Anglo-French Boundary Commission in West Africa.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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Hudson Str.
Davis Str.
60 E.V. Derbishire 50
140
120
110
100
90
80
70

NORTH POLAR MAP TO ILLUSTRATE DR. NANSEN'S PAPER.

Currents after Dr. Nansen.

Scoresby Sound from the map acc

Lieut. Ryder's Pap

Independance Bay from a Sketch

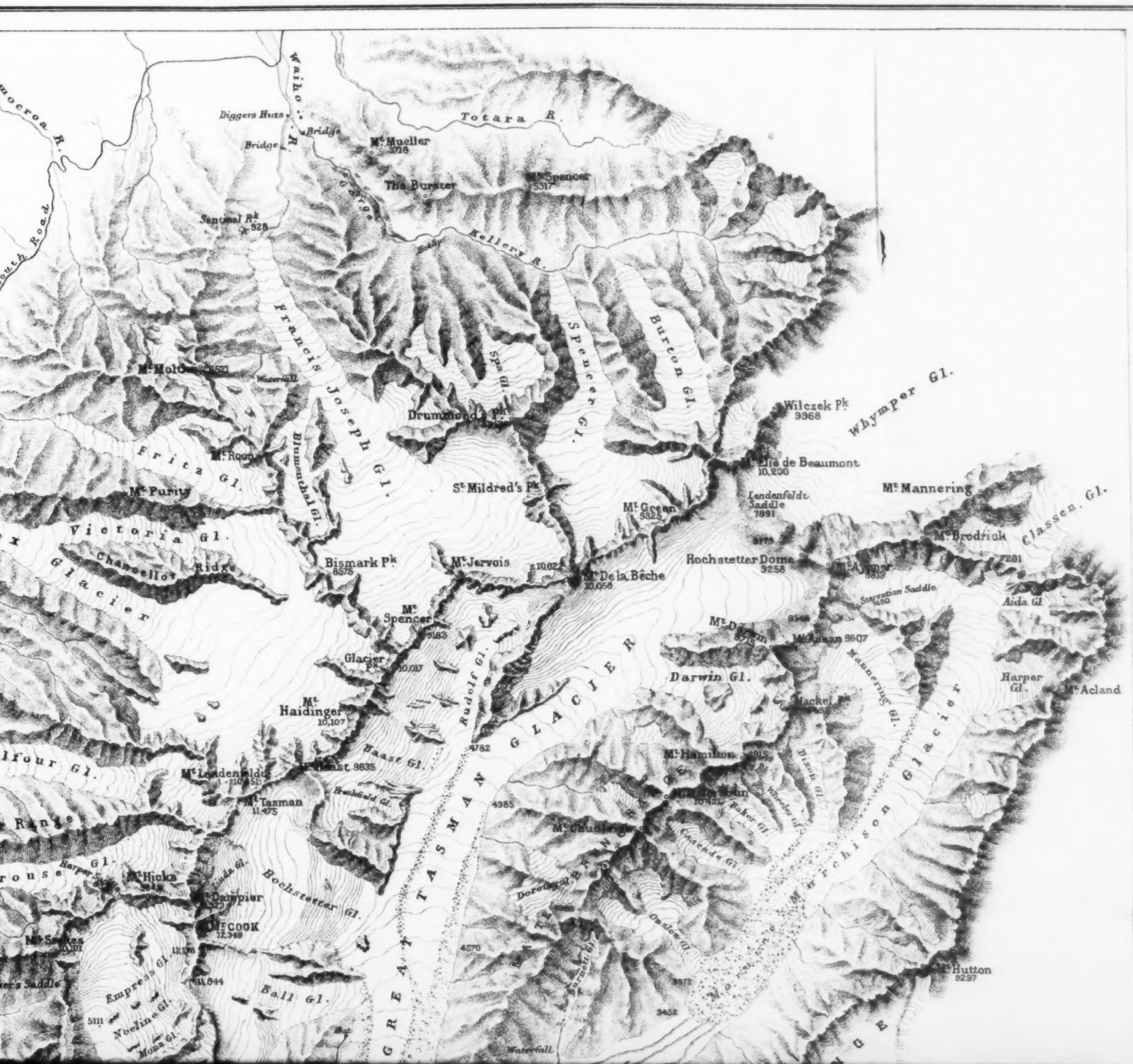
the "New York Sun", Octob

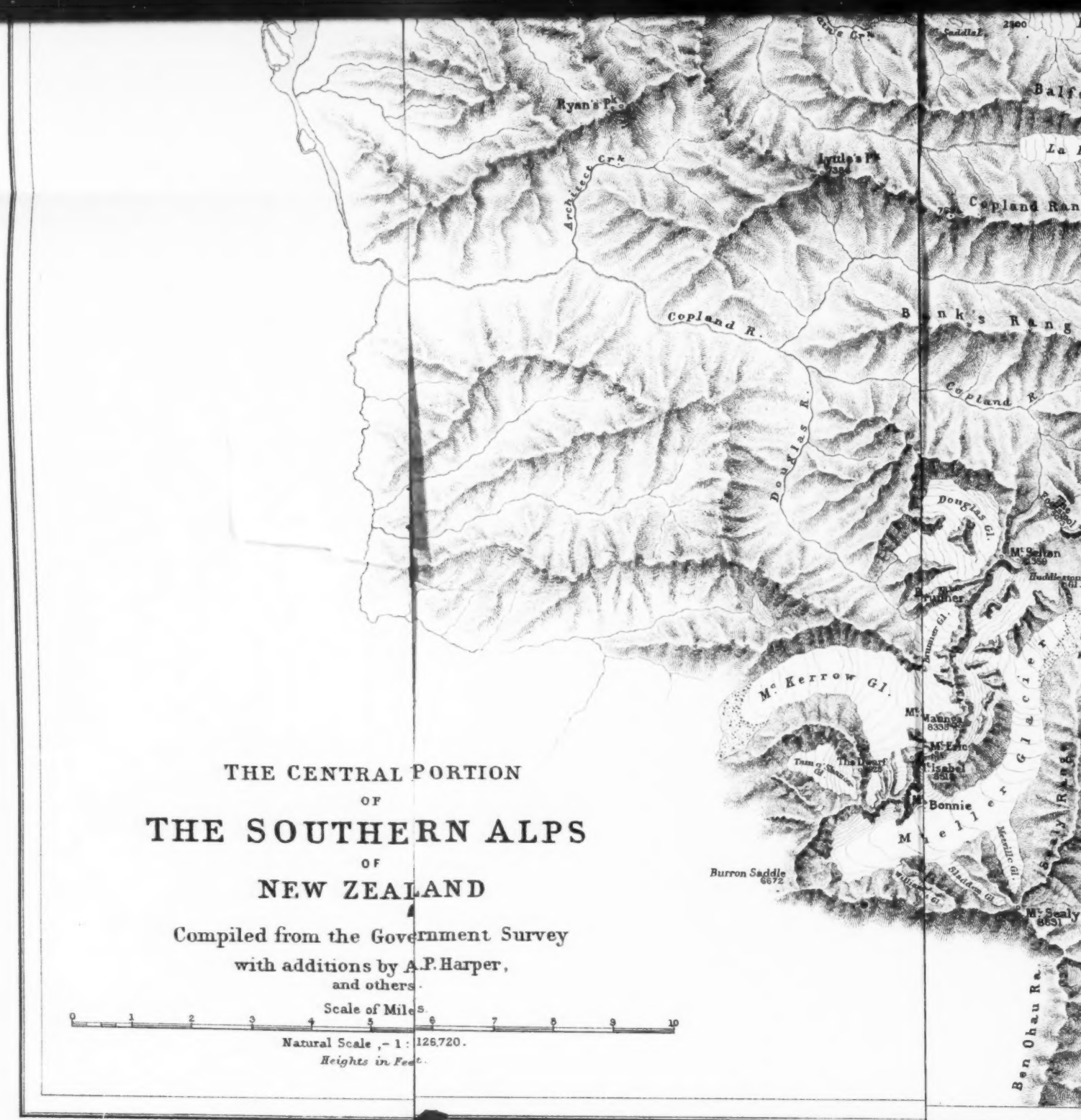
...accompanying
...Paper.
...ch map published in
...ctober 25th 1892.

F.S.Waller, Lith.

Published by the Royal Geographical Society.

Gilles
(Tow
s Beach
ip)
Ferry
L. Gibbs
L. Mueller
L. Gault
L. Lyttle
Waikukupa R.
South
Lyttle's Ho.
Myer's Ho.
C
OK RIVER
Fox R.
Ryan's Ho.
296
Hot. Sulphur Spr
Oinetamatea R.
Karangarua R.
Mt Fox
Diggers Huts
Foot Br.
Fox
Craig's Pk
Craig's
Scott's Ho
Impassable Gorge
Mt Barnes Crk
Saddle
2500
Balfo
Balfour R
Ryan's Pk
La Perou
Lyttle's Pk
Architect Crk
Copland Range
Baker's
Copla
Banks Range


Totara R.
Diggers Huts
Bridge
Bridge
Mt Mueller 9716
Mt Spencer 5317
The Buster
Sentinel Pk 928
Kellery R.
Francis Joseph Gl.
Spencer Gl.
Burton Gl.
Whymper Gl.
Drummond Pk
Wilczek Pk 9968
Mt Elie de Beaumont 10,200
Mt Purity
Victoria Gl.
St Mildred's Pk
Mt Green 9325
Lendenfeldt Saddle 7891
Mt Mannering
Mt Brodrick
Classen Gl.
Bismark Pk 8575
Mt Jervois
Mt De la Bêche 10,056
Hochstetter Dome 9258
Aida Gl.
Mt Spencer
Glacier Pk
Darwin Gl.
Mackel Pk
Harper Gl.
Mt Acland
Mt Haidinger 10,107
Rudolf Gl.
Haast Gl.
Mt Hamilton
Mt Tasman 11,475
Hochstetter Gl.
Mt Hicks
Dampier
Mt COOK 12,349
Mt Sealy
Empress Gl.
Ball Gl.
Nuella Gl.
Mona Gl.
Mt Hutton 8297
Waterfall



THE CENTRAL PORTION
OF
THE SOUTHERN ALPS
OF
NEW ZEALAND

Compiled from the Government Survey
with additions by A.P. Harper,
and others.

Scale of Miles.

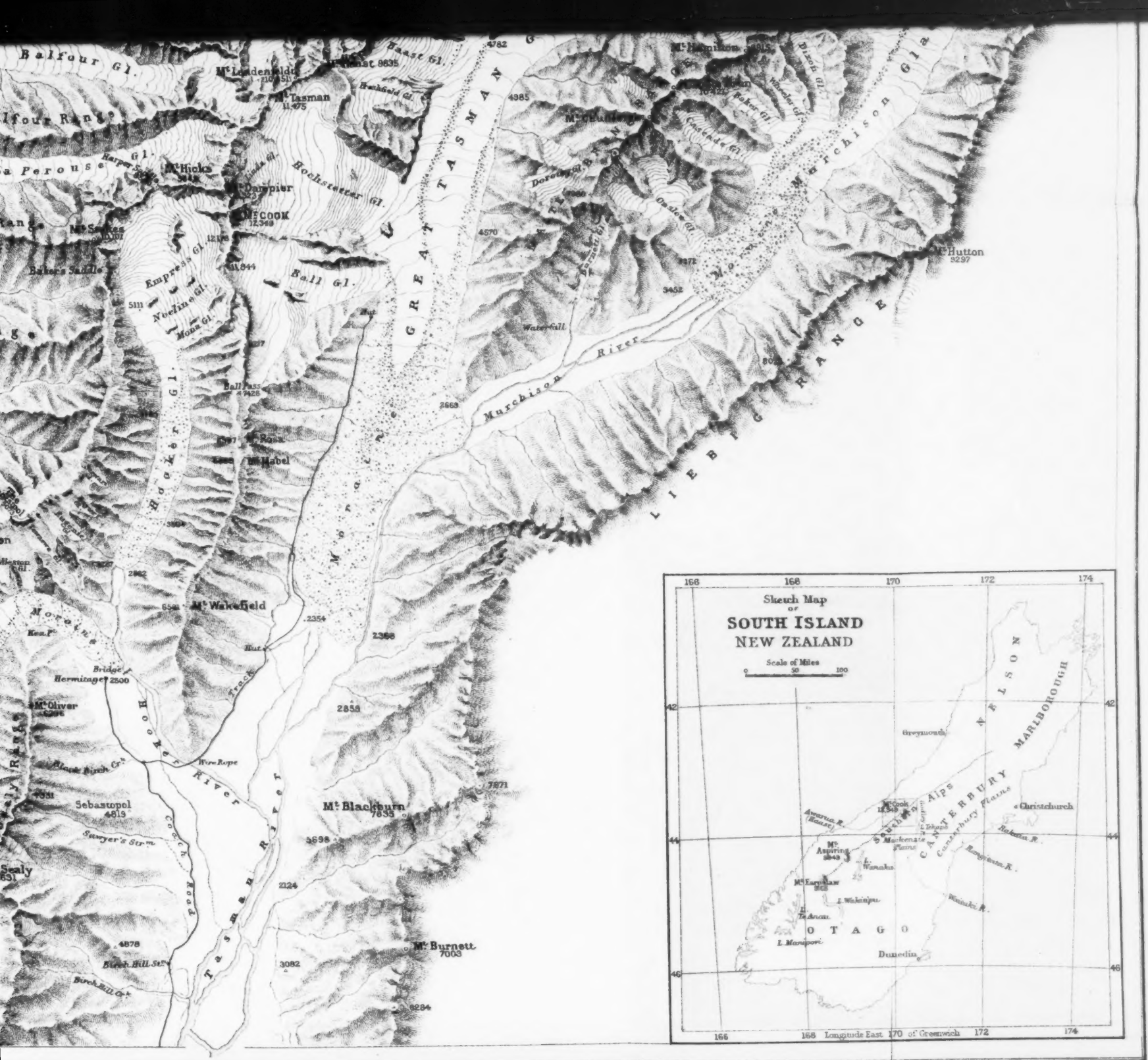
0 1 2 3 4 5 6 7 8 9 10

Natural Scale, - 1 : 126,720.

Heights in Feet.

H. Sharbau, R.G.S. del.

Published



F S Weller, lith

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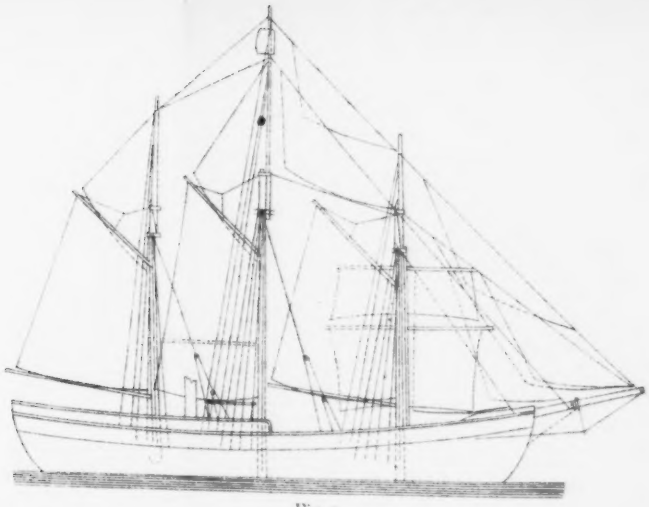


Fig. 1

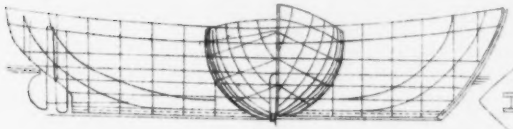
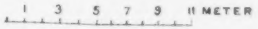


Fig 2



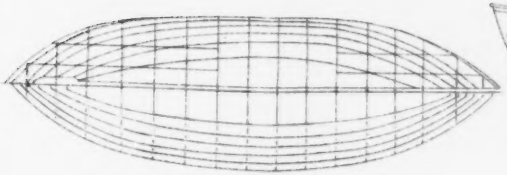


Fig. 3.

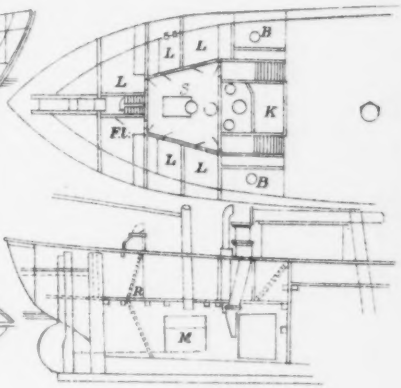


Fig 4.

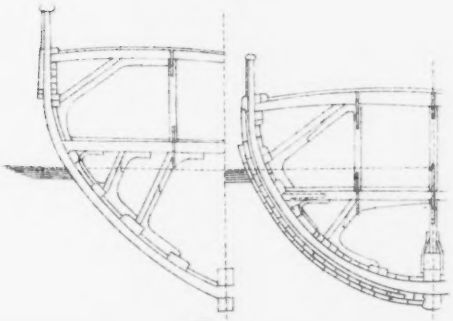


Fig. 5.

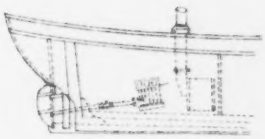


Fig. 6

DIAGRAMS OF DR. NANSEN'S VESSEL, THE "FRAM."

Published by the Royal Geographical Society.

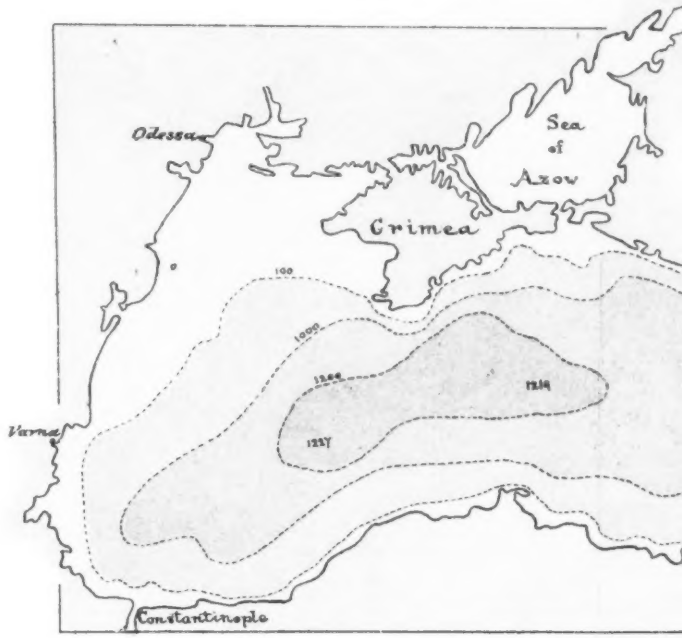


Fig.3.

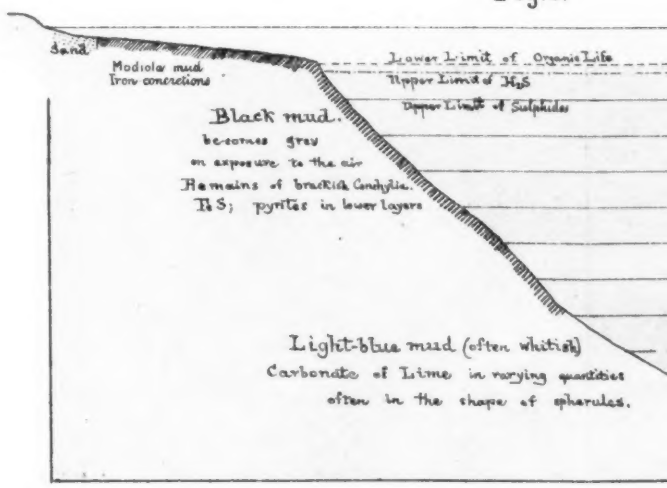
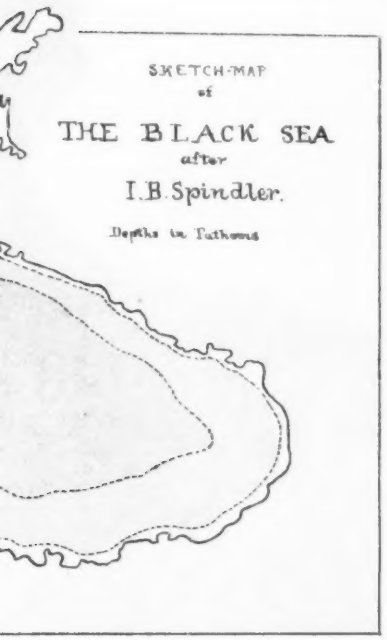
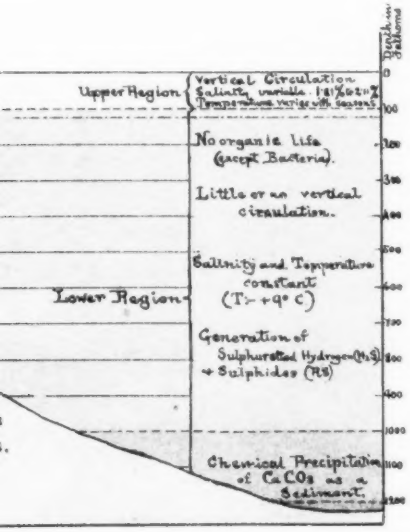


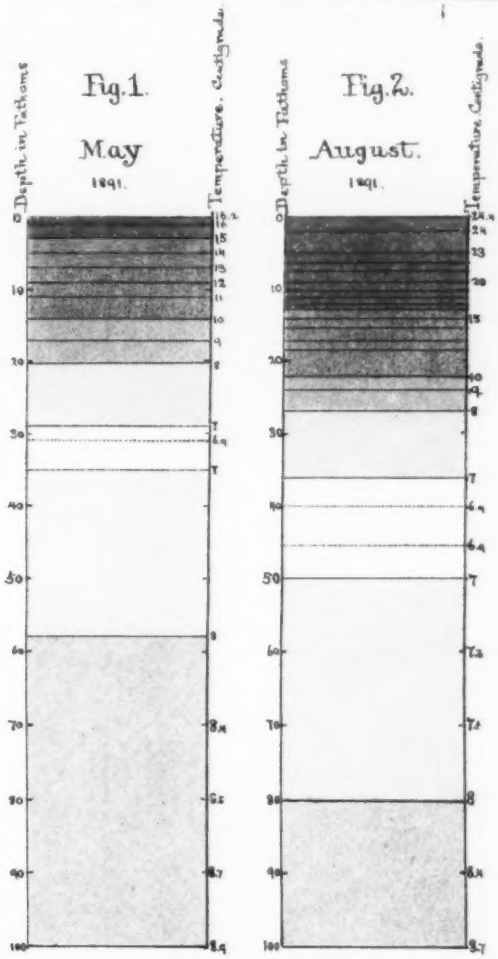
Diagram of the physical and biological conditions

B.V. Wardlothire.





tions of the Black Sea.



Distribution of Temperature
in the Surface-layers
of the
Black Sea.

From observations taken in the summer of 1891.

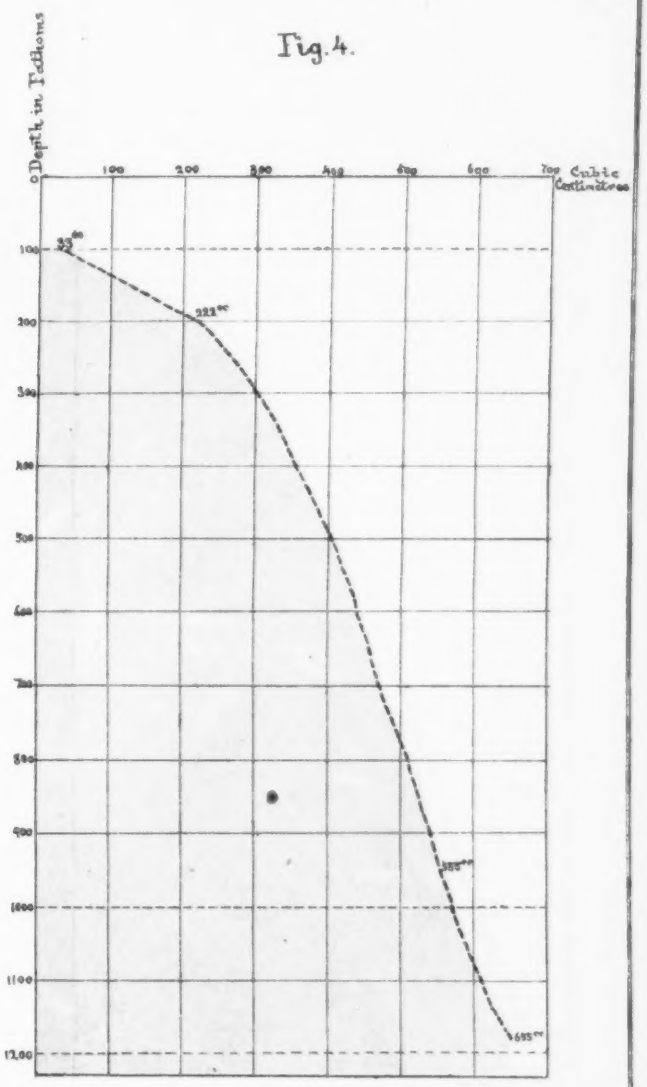


Diagram showing number of cubic centimètres of H_2S
contained in 100 litres of water.
at varying depths.
(after Lebedintzeff).